September-October 1956

cop. 1

Communications—Electronics—Photography

SIGNAL

10th Anniversary ISSUE

THE WHITE HOUSE
WASHINGTON

August 1, 1956

To my friends and former comrades in the Armed Forces Communications and Electronics Association I extend warm greetings on the occasion of its tenth anniversary

A modern defense force relies greatly upon its communications system and upon its employment of electronics and photography. Consequently it is of vital interest to national security that developments in these fields meet military necessities.

Through your Association, officials of government and industry cooperate to insure that the design, production and maintenance of communications, electronic and photographic equipment will meet the requirements of our armed services now and in the future. I congratulate all of you on this patriotic and vital service of the Association through the past ten years.

Sincerely,

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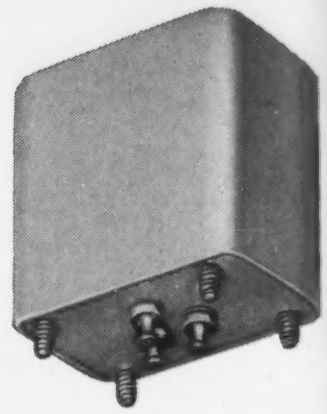

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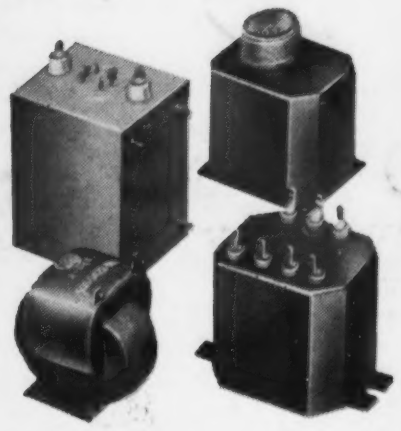

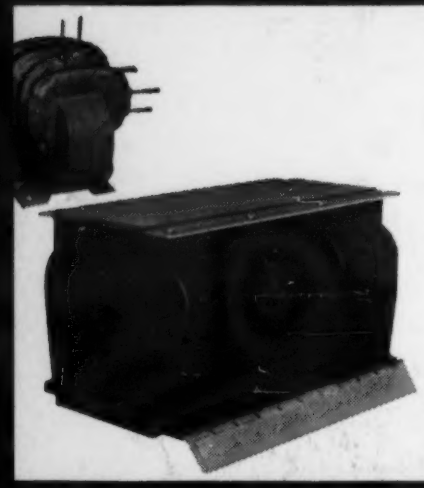

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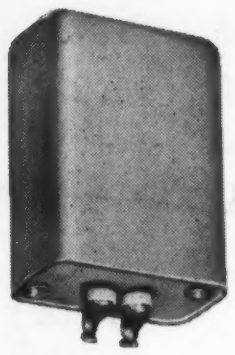

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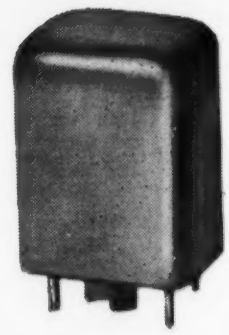

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Editor
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Advisory Editor
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Managing Editor
JUDITH H. SHREVE

Chapter News Editor
JULIA B. GODFREY

Associate Editors
CHARLES DeVORE
GEORGE C. RUEHL, Jr.
DR. HAROLD A. ZAHL

Contributing Editors

Army
LT. COL. L. J. FISHKIN, SigC.

Navy
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Air Force
MAJ. JAMES H. MABRY, USAF

Photo News
FRANK SMITH

Business Manager
BURNETT R. OLMSTED

Circulation Manager
DORIS NICHOLLS

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BPA

SIGNAL

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On this, the Tenth Anniversary of SIGNAL,

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General H. C. Ingles

as the motivating force behind the formation of the A.F.C.E.A.

The energy and understanding that he has contributed to the organization through the years is deeply appreciated by all who are privileged to enjoy its benefits.

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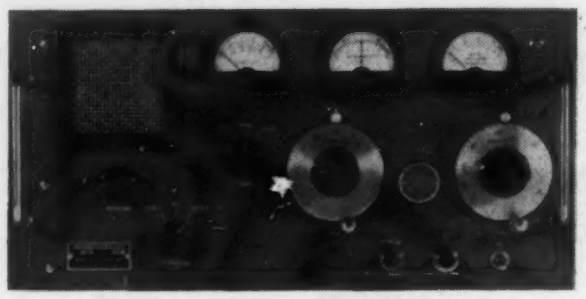

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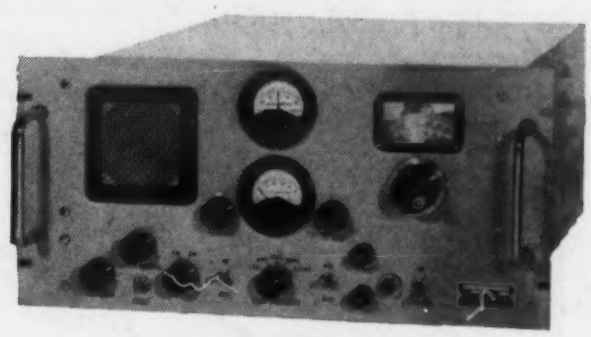

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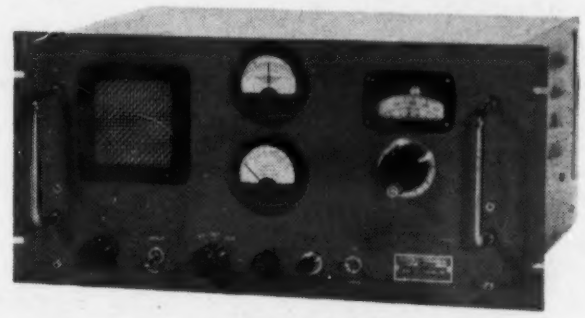

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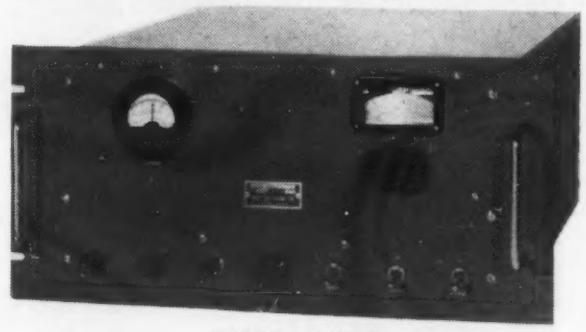

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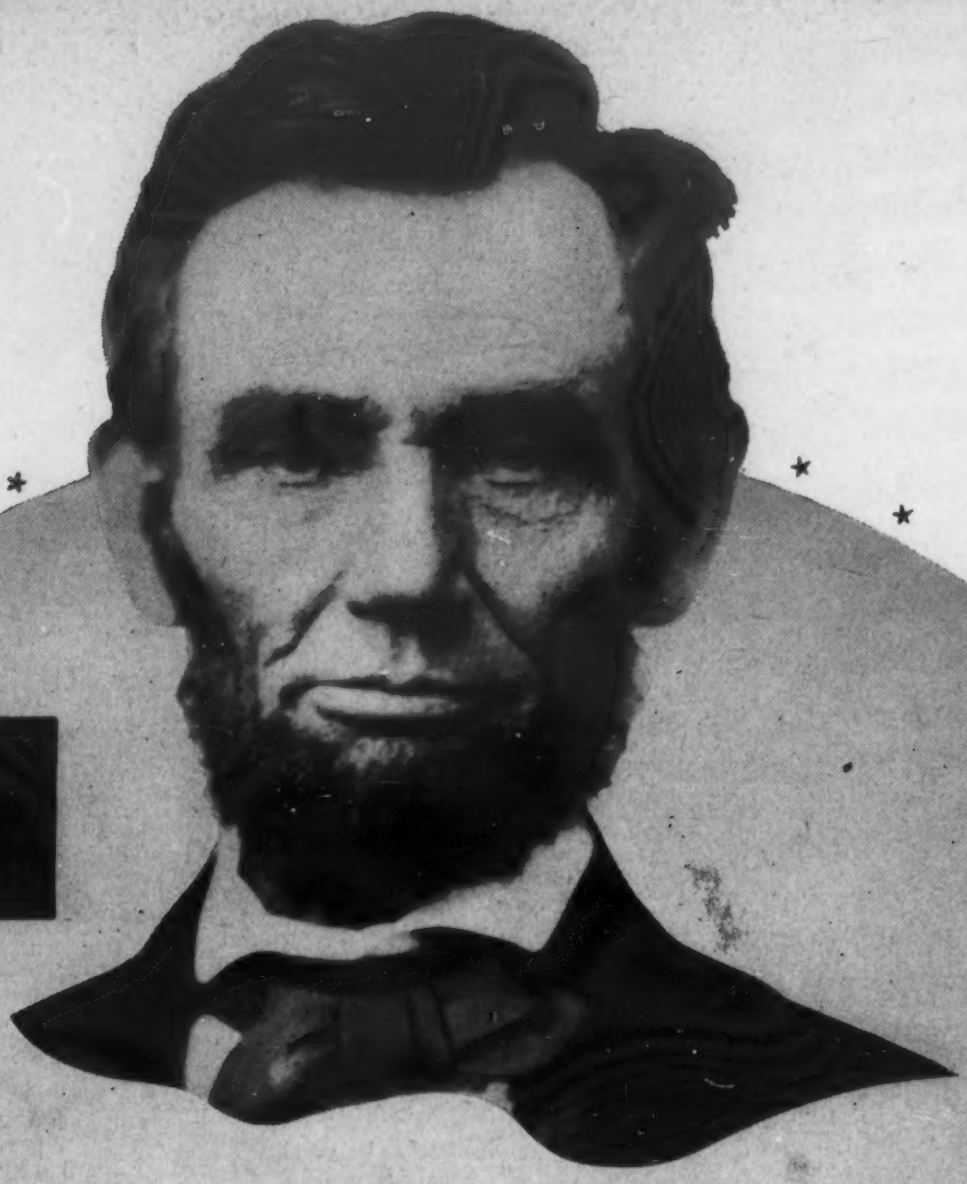

Guide words for today —

"Must I shoot a simple-minded soldier boy who deserts, while I must not touch a hair of a wily agitator who induces him to desert?"

ABRAHAM LINCOLN

Lincoln's timeless truths were phrased in a style so simple that their meaning was unmistakable. In the above statement Lincoln makes it clear that he believed in fixing responsibility upon the prime movers . . . those who motivate others to commit overt acts against our country. What would Lincoln think of today's "liberals", who are not Communists themselves, but who condone Communist subversion and treason under the guise of "civil liberties"? There can be no doubt that he would crash his contempt upon such men.

W. B. Stuart

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The flight date of the first atom-powered airplane may well be advanced as the result of a study being conducted by Admiral for the U.S. Air Force. The problem is to determine the effects of nuclear radiation on electronic components.

All types of electronic components . . . such as tubes, resistors, condensers, capacitors and coils . . . are first bombarded by neutrons to make them radioactive prior to observation and testing.

Admiral has equipped a special nucleonics laboratory to make this study. Test equipment is set up within heavily shielded "hot cells" and operated by remote controls outside each room. One of the "hot cells" contains environmental chambers for testing the radioactive components under extreme temperature and altitude conditions. The laboratory also contains shielded underground storage facilities and a cobalt 60 source of gamma radiation as powerful as some atomic reactors.

Working with radioactive materials is not new to Admiral. For the past seven years the company has been engaged in designing, manufacturing and testing radiation measurement equipment. In this connection Admiral engineers have contributed much to the combined nucleonic-electronic sciences.

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The new IRC PW-5 Wire Wound Resistor now opens up new possibilities for miniaturization and cost savings in resistance capacitance filters, radio and TV circuits, bridge circuits, attenuator networks, and many other circuits. With this new 5-watt resistor, you can now obtain the superior insulating and high temperature characteristics as found in IRC's famous PW-7 and PW-10 units. The PW-5 also offers you the same extra terminal security resulting from simultaneous assembly of element, leads, and terminal clips in one automatic operation. This latest addition means that you now can specify IRC for *all* medium power requirements.

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SIGNAL

Tenth Anniversary Issue

Never before in the history of our Country has the amalgamation of our Civilian-Military team meant so much to national security. This concept has been profoundly exemplified over the past ten years through the cooperation of our authors, advertisers, printer, members, and capable leadership of the officers of the Association. SIGNAL proudly expresses its appreciation to these individuals and sincerely dedicates this issue to them.

The Editor

UMI

From the President

The magnificent record in this past decade, under the brilliant guidance of two AFCEA pioneers, Steve Sherrill and George Dixon, causes one to hesitate before moving on into another era. Brig. Gen. Stephen H. Sherrill, with his organizing ability, sincerity and effort, set the standard and built in the stamina of the organization, which made it outstanding in its field. Col. George P. Dixon, by his genial personality, enthusiasm and courage, preserved and fostered the spirit of fellowship among the members of the Association and brought it to maturity.

The unification of the Armed Forces resulted in the expansion of the Association from its original conception as the Army Signal Association to an Army, Navy, Air Force organization. This integration was not easily accomplished, since radical differences in concepts of communications and electronics existed. To arouse a widespread interest among the communicators of the Services was a task of no mean proportion. That this task was accomplished and that today the Navy and the Air Force are equally enthusiastic supporters of the AFCEA is in no small measure attributable to the efforts of these two men.

The broadening of the name of the Association to include "Electronics" in recent years may be considered inevitable in keeping pace with modern technology. However, a glance at the group membership and advertising shows, by the number of times the word *electronics* is used, how successful this move has proved to be.

SIGNAL has grown in size and influence these past ten years. From 68 pages in the first issue of September-October 1946 to a record of 138 pages in the May-June issue this year, we see reflected editorial and advertising growth which is the result of the efforts of many. The future of our magazine holds great promise for our members and readers, and SIGNAL will continue to grow even more influential and important in the communications-electronics field.

Another step forward for the AFCEA was made last spring when the annual convention was placed on a self-supporting basis. Heretofore, exhibits had been solicited from the Armed Services and funds raised through voluntary contributions from group members. This year, space was sold to industrial exhibitors and the convention not only paid for itself, but contributed substantially to the National Headquarters.

During all of this period of expansion, the chapters have multiplied and grown in strength. With the spread of the AFCEA beyond the continental limits of the United States to England, Iceland, France, Italy, the Philippines, Switzerland, Japan and Korea, the influence of AFCEA has taken on an international aspect never conceived of by its founders.

Through all of these changes the initial concept of the Association has never deviated, and today, more than ever, the AFCEA remains an association of men in both industry and the Armed Forces dedicated to the defense of our Nation. Through the mutual respect and trust of individuals who work together for a common purpose from the top level in Washington to the local level of the chapters, the strength of AFCEA is firmly founded.

I shall have to reserve our plans for the coming year for the next issue, but I want to extend to each and every member my best wishes and congratulations on being a part of this Association.

Percy G. Black

National President

UMI

AFCEA HISTORY

A conference was held at the Pentagon on September 25, 1945 to discuss the organization of the Army Signal Association. Present at this meeting were: Keith S. McHugh, American Telephone & Telegraph Co.; Theodore S. Gary, Automatic Electric Co.; W. P. Hilliard, Bendix Radio; R. C. Cosgrove, Crosley Corp.; Paul Galvin, Galvin Manufacturing Corp.; W. R. F. Adams, General Cable Corp.; V. M. Lucas, General Electric Co.; William C. Henry, Independent Telephone Association; George P. Dixon, International Telephone & Telegraph Corp.; Martin F. Shea, Philco Corp.; David Sarnoff, Radio Corp. of America; Arthur F. Gibson, Stromberg-Carlson Co.; C. J. Burnside, Westinghouse Electric Corp.; William F. Hosford, Western Electric Co.; Mr. Egan, Western Union Telegraph Co.; J. J. Nance, Zenith Radio Corp.; Leighton H. Peebles and Mr. Karnes, War Production Board; Leo A. Codd, Army Ordnance Association; RAdm. Joseph R. Redman, USN, Director of Naval Communications; Vice Adm. Edward L. Cochrane, USN, Chief, Bureau of Ships; Commodore Jennings B. Dow, USN, Bureau of Ships; Maj. Gen. H. M. McClelland, Air Communications Officer, Army Air Corps; Maj. Gen. J. A. Code, Jr., Assistant Chief Signal Officer, and Brig. Gen. Edward Clewell, Chief, Procurement & Distribution Service, OCSigO

AFTER THE WAR BETWEEN THE States, an organization known as the United States Veteran Signal Corps Association was formed by the veterans of Major Albert Myer's Union Signal Corps and continued in existence for many years.

As this Civil War group became too old to take an active part in the organization, they encouraged the veterans of the Spanish-American War to form a Spanish War Division of the U. S. Veteran Signal Corps Association. This division was active until 1950 when the last meeting was held at Fort Monmouth, N. J.

Following World War I, Brig. Gen. J. J. Carty, chief engineer of the American Telephone & Telegraph Co., together with Maj. Gen. Charles McK. Saltzman, then Army Chief Signal Officer, organized the American Signal Corps Association with chapters in many of the larger cities throughout the country. General Carty was the first and only national president.

This association did not last long as a national group, but several individual chapters continued for a number of years. In such areas as Chicago, Boston, San Francisco, and New York, the association persisted under the leadership of Signal Corps' veterans and other individuals who were interested in keeping the organization alive. However, as the key men moved to other localities the chapters became inactive.

The New York Chapter was reactivated in 1930, and in 1935 incorporated with it the World War Division of the U. S. Veteran Signal Corps Association. This chapter met until World War II.

After World War II, Maj. Gen. H. C. Ingles, Army Chief Signal Officer, and a group of Service and industrial leaders interested in communications, electronics and photography, agreed on the necessity for an organization that would foster the spirit of fellowship among former, present, and future Service and industrial people in those fields. In May, 1946, they organized the Army Signal Association.

Brig. Gen. David Sarnoff (then president and now chairman of the board of the Radio Corporation of America) was named the temporary president of the new ASA. Other interim officers were: William J. Halligan, Darryl F. Zanuck, and Fred Friendly, vice presidents. The interim officers named General Ingles their honorary president. At the time of the planning of ASA, it was decided to set up a permanent national headquarters in Washington, D. C., and the group appointed Brig. Gen. Stephen H. Sherrill to be the organization's executive secretary.

Directors of the new association included: Carroll O. Bickelhaupt, George P. Dixon, Harry A. Ehle, Paul Galvin, Theodore S. Gary, W. L. Hallahan, William C. Henry, H. W. Hitchcock, Frank B. Jewett, J. Harry LaBrum, Fred R. Lack, Leslie F. Muter, John J. Ott, Jr., Thomas A. Riviere, and Harold A. Zahl. Legal Counsel was Frank W. Wozencraft.

The first ASA publication, called the *SIGNAL Bulletin* (predecessor of the present *News Letter*) appeared in May 1946, and SIGNALS (changed to SIGNAL in 1950) datelined its first issue in September-October 1946.

The first chapter to be chartered was New York, where the World War Division of the U. S. Veteran Signal Corps Association and the New York Chapter of the American Signal Corps Association merged into Chapter No. 1 of the new ASA.

Other chapters which were chartered during the first year of the organization were: Fort Monmouth, Chicago, Washington, Philadelphia, Decatur, Sacramento, Cleveland, Salt Lake-Ogden, European, Richmond, Baltimore, Oklahoma A&M College and Texas Technological College. At the present time, there are 47 active chapters in the Association.

The first convention was held on April 28 and 29, 1947, at Fort Monmouth. At this time, General Sarnoff was elected president of the ASA for a two-year period by the membership.

At the time of the unification of the Services in 1947, the name of the Association was changed to Armed Forces Communications Association, and in the Fall of 1954, after considerable deliberation by the directors and chapters during the previous year, it was voted unanimously to change the name to include "Electronics," thereby becoming the Armed Forces Communications and Electronics Association.

In January 1950, General Sherrill re-

(*Continued on page* 77)

From AFCEA'S First Officers

General Sarnoff

General Ingles

It was my good fortune, as the first president of what was then called the Army Signal Association, to be present at the birth of SIGNAL, ten years ago this issue.

This magazine and the organization which sired it grew out of a realization and a necessity. The realization was that electronics would play an increasingly important role in military defense. The necessity was a dynamic program of electronic development which only the closest coordination between the Armed Services and private industry could achieve.

Time and events have fully demonstrated the correctness of these concepts. Within ten brief years, weapons and techniques have been devised which have swept traditional theories of national security into the dustbin of history. The heart of many of these fantastic developments has been the electron.

The nature of these developments has greatly advanced the relationship between industry and the military services. The complexity of the new weapons emphasizes the need for cooperative efforts before a crisis is upon us; for today's drawing boards and production lines may decide the outcome of future conflict.

The liaison between industry and the military must be drawn ever closer. Each must know the other's needs and problems, skills and resources. Each must call upon the other for mutual strength and knowledge.

This was the service which SIGNAL was called upon to supply—to help provide a link between the military and industry and a forum for the interchange of ideas and knowledge. The measure of its success may be seen in the growth of the magazine since its first issue.

As SIGNAL has grown, the interest, variety and range of its printed articles have expanded proportionately. Today it is required reading for anybody concerned with the development of electronics and our national defense. With ten chapters of AFCEA established overseas, SIGNAL has also become an international publication, read with equal interest by our friends and allies abroad.

The ten-year file of SIGNAL provides a running story, many chapters of which were undreamed of when the first edition was published. Great has been the progress in all forms of electronic communications on land, sea and air.

My congratulations then to SIGNAL on its first ten years of accomplishment and my best wishes for all the years of service ahead.

David Sarnoff
President

The tenth birthday of the AFCEA finds a healthy and robust youngster who is still growing. The Editors believe that most members will be interested in the birth of this lusty member of the Defense family and have asked me to give a brief account of it.

Toward the end of the war, several officers, both Regular and Reserve, of the Signal Corps, the Navy and the Air Force began to discuss means by which the fellowship between Reserves and the Regular officers and the splendid cooperation between industry and the Armed Forces could be continued into peace time. Many of us had been through World War I and the reorganization following it, and had seen the ties with the Reserve and the close cooperation between industry and the Armed Forces gradually nearly disappear after that war. When World War II hit, we realized that preparedness would have been much further along if they had been kept alive.

In order to promote discussion, crystallize ideas on the subject and draw upon the cumulative experience of many, the writer, who was then Chief Signal Officer of the Army, wrote a number of Regular and Reserve officers of the Army, Navy and Air Force and the heads of the principal companies in communication and electronics fields, inviting them to a conference in Washington to discuss the subject and formulate a course of action.

A total of about twenty-five were invited and all accepted. After several hours of discussion, it became evident that all present favored the organization of an association that would carry out the objectives mentioned above. On the motion of Mr. Keith McHugh, President of the New York Telephone Company, a committee was appointed to draft a form of organization, a constitution and by-laws. This was done and the Chief Signal Officer of the Army appointed Brigadier General David Sarnoff as interim President and Brigadier General Stephen H. Sherrill, Retired, as Executive Secretary until such time as a Board of Directors could be elected which would then regularly elect a National President.

The Navy did not come into the organization at first as the Navy Industrial Association had just been organized and it was thought that would serve the same purpose for the Navy. Later the Navy assumed a very active role and the name was changed to Armed Forces Communications Association and then still further broadened to the present time.

H. C. Ingles
Honorary President

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On its tenth anniversary, the Armed Forces Communications and Electronics Association is to be congratulated—for its growth as a partnership between military and industry, and for its contribution to the growth of our country.

Developments in communications, electronics and photography during the decade of exciting yesterdays will be even greater in the next decade of wondrous tomorrows.

W. J. Halligan, Sr.

1st Vice President

The motion picture industry salutes the Armed Forces Communications and Electronics Association for meeting its first ten-year challenge. Our progress in the past ten years has been marked by the growth to maturity of communications, electronics, and photography. Little did we realize in 1946, the Association's first year, the potential changes just over the horizon. No better proof of the stability of the enterprise and the soundness of the original concepts can be had than forward progress during such a changing cycle.

Darryl F. Zanuck

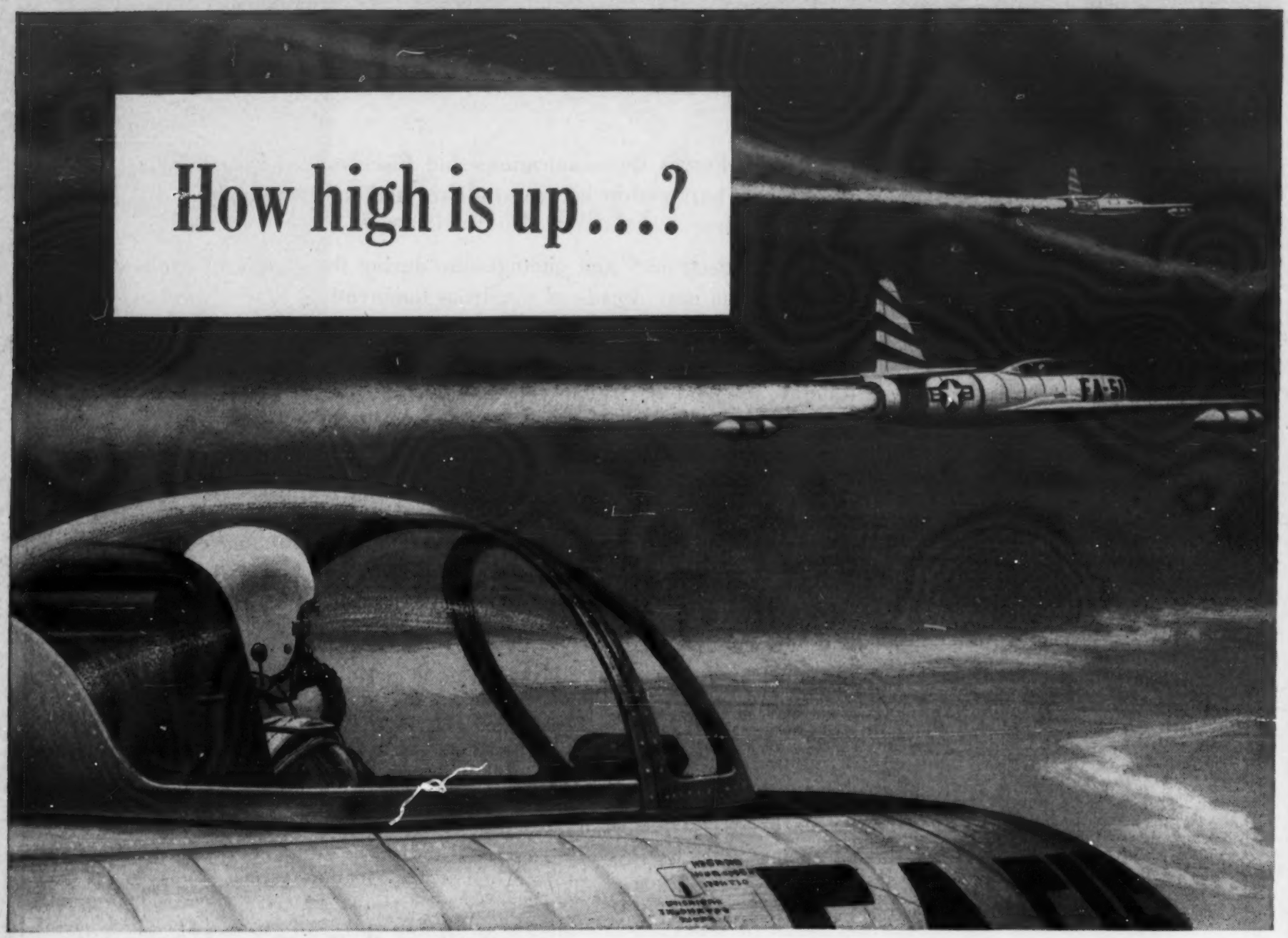
2nd Vice President

AFCEA has been the catalyst which has drawn together those in the Services and in industry who are interested or engaged in communications, electronics, and photography. Participation in membership activities has been fun, but the important thing is that AFCEA has made a very real contribution to the national defense—and the first ten years have been but the beginning. The need for the Association will continue to grow as the importance of electronics and communications and photography will continue to grow. "What is past is prologue."

Frank W. Wozencraft

Legal Counsel

UMI



Up is as high as it's necessary to go . . . when somebody calls the turn upstairs! And down here, we're in trouble . . . unless the complex electronic equipment that protects and guides our military aircraft is unfailing. That's why superiority of product is a way of life at Hallicrafters . . . why the Hallicrafters Company has been a leader in the field of electronics for more than 20 years.

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ELECTRONICS ...modern jinni

by Dr. W. R. G. Baker

THE ELECTRONICS INDUSTRY TODAY IS GROWING LIKE a jinni let out of a bottle. And, like the proverbial jinni, the electronics industry is granting wishes and performing tasks that surpass the wildest dreams of ancient Arabia's story tellers.

In a sense, the work of the jinni hasn't changed much through the centuries—we're still using its mystical power to help fly our 20th century flying carpets, but our modern magic lamps are called electronic tubes.

Let's take a quick look at the size of this young industrial giant. One out of every 40 persons employed in the United States today, or 2.7 per cent of our work force, is employed in the electronics field. And the amazing thing is that 75 per cent of the jobs didn't even exist just 10 years ago.

Growing 81 per cent since 1950, the electronics industry has mushroomed up to the $9 billion annual product and service level, providing employment for 1.75 million Americans. Many forecasters believe the industry will reach the $15 billion level by 1960.

In order to put this rapidly expanding industry into its proper perspective, let's take a glance now at the U.S. economy as a whole.

Perhaps the best yardstick is the Gross National Product—the GNP—which represents the Nation's total production of goods and services. In 1939, the GNP stood just over the $91 billion mark. At the end of World War II, it had risen to $209 billion. In 1955, the figure reached the $400 billion rate for the first time. And some experts predict that in the next ten years a gain of 40 per cent will be registered, pushing the GNP up to $570 billion, at 1956 prices with no allowance for further inflation due to price increases.

Disregarding the reconversion year of 1946, our total work force increased 13 per cent in the period 1947-1956. At the same time, the GNP increased 41 per cent. In the next ten years, it is estimated that the total work force will increase 14 per cent.

So, we can see that in 10 years only 14 per cent more workers will have to produce 40 per cent more goods and services in order to provide for a rapidly growing population which will probably hit the 200 million mark in the same period.

Other figures which throw some light on the U. S. economy are statistics on electric power generation and its use in both industry and in the home. In the past nine years electric power generation has increased from 307 billion kilowatt-hours in 1947 to an estimated 680 billion in 1956. By 1966, it is predicted that 1.5 trillion kilowatt-hours will be needed, an increase of 123 per cent.

Electricity used per man-hour in the manufacturing and mining industries increased from 5.5 kilowatt-hours in 1947 to an estimated 10.2 in 1956. The goal for 1966 is 21 kilowatt-hours per man-hour.

In our homes, electrical energy consumption per residence doubled from an average of 1,439 kilowatt-hours in 1947 to nearly 3,000 this year. By 1966 it is expected that the average home will use 2.5 times as much, for an average of 7,500 kilowatt-hours.

Historically, the electrical industry has been growing at almost twice the rate of the Gross National Product, doubling in size every ten years. And the electronics industry has been growing twice as fast as the electrical industry, doubling in size every five or six years.

West Coast Expansion

Although new electronics plants are springing up all over the country, in recent years there has been particularly notable expansion on the West Coast and in the northeastern part of the country.

In the Los Angeles area, new electronics plants have been built at the rate of one a week since 1947. In the first six months of 1955 there were 32 new and expanded plants representing a total capital investment of almost $14 million. In this area more than 460 firms in 530 plants now employ more than 72,000 persons. This represents about 75 per cent of the total electronics employment in the West. The annual payroll for the Los Angeles area is about $294 million and the estimated 1956 industry billing is an impressive $1 billion.

Three main factors have contributed to the growth of the industry in southern California: the proximity of a large segment of the aircraft industry, the climate, and a steady stream of engineers and other technicians who are graduated from nearby schools and colleges.

The Author

Dr. W. R. G. Baker, vice-president of the General Electric Co. and a national director of AFCEA, has had nearly four decades of experience in telecommunications. Recently elected president of RETMA, he has won much acclaim for his leadership in the study of many of the electronic industry's problems.

In the San Francisco Bay area, there has been a substantial expansion since the beginning of the year. About a dozen companies have announced building plans that will add about 1 million square feet of space to their operations. Electronics research is on the upswing in the Bay area, too. A handbook of scientific resources in this section lists 28 firms that now have research laboratories. These firms employ about 15,000 workers.

In New England, the electronics industry can take a large share of the credit for reviving the labor market during the gloomy years when the fading textile industry put 100,000 workers on the streets. The Associated Industries of Massachusetts reported that a survey completed late in 1955 shows more than 450 electronics firms compared to about 300 firms in 1952.

A more recent survey by the Federal Reserve Bank of Boston's *New England Business Review* shows just 123 reporting firms employed more than 56,000 persons and their 1955 sales reached $612 million. These firms increased plant space about 23 per cent between January 1953 and October 1955. And, if present expansion plans are carried out, they will spend $67 million for new plants and equipment, expand manufacturing space by 18 per cent, and add about 8,000 workers in the next few years.

As throughout the country, research and development activities are playing an important role in bringing out new products and creating jobs in New England. In this older industrial area, the number of electronics companies with research and development programs expanded by more than 50 per cent between 1950 and 1954, and annual expenditures for such activities advanced from $26 million to $42.6 million. Over half the electronics employees in New England in 1955 were working on products developed by research within the past five years.

One of the major reasons for the rapid and continued growth of the whole electronics industry is that it is a vital factor in both the commercial world and in our national defense. Research in military fields finds a commercial adaptation; commercial product research often helps the military.

The radar that saved England from the Luftwaffe now helps our commercial airplanes land safely in fog, rain, and darkness. The television set that enables us to watch the World Series in our living room soon may help the infantry combat commander seek out and destroy enemy strong points.

Higher Productivity Needed

Furthermore, technology has outstripped the capabilities of the human body in many fields. Mere mortals can no longer aim heavy anti-aircraft guns fast enough or accurately enough to shoot down jet planes; nor can they keep world-wide military inventories up-to-date without electronic help.

In the commercial area, we have seen that in the next 10 years we must produce 40 per cent more with only 14 per cent more workers. This means that higher productivity is necessary. The fastest way—yes, probably the only way—to achieve this is through increased use of automation. And this is a field in which electronics excels.

In the field of automation, our responsibility is twofold: we must increase our own use of automation, and we must supply other industries with automatic equipment systems.

Today, industrial applications of electronics systems and components are being used to perform many tasks formerly done by human beings, from the operation of elevators to the calculation of payrolls.

There is even electronics help for the fellow who had trouble sorting potatoes into piles of big ones and small ones. You remember he complained that though the work wasn't too hard, "It's these decisions that are killing me." New electronic machines will make that sort of decision—one is being used now to sort lemons into five different color groups, ranging from dark green to tree ripe. And this machine's eyes don't get tired at the end of the day!

Fields of Electronic Application

Electronic equipment is being used to guard warehouses, to set pins in bowling alleys, and to provide visual checks on freight cars far from the dispatcher's office. Robot electronic stations at sea automatically transmit meteorological data.

Two of the important industrial uses of electronics are in computers and in closed-circuit television. One of our large companies has recently set up a data processing center where electronic brains will assemble, analyze and interpret commercial data from plants all over the country.

One of the country's large banks is installing electronic computers which will perform daily bookkeeping tasks for 55,000 commercial checking accounts, manned by only eight operators and clerks. It will sort checks and deposit slips, maintain correct balances, and immediately notify the operator of an overdrawn account. It cannot make an error in arithmetic. Apparently the only thing it cannot do is to convince the woman who has trouble balancing her check stubs that she, not the computer, is wrong.

Industrial television has many fields of application: materials handling control, testing equipment, radiation and nuclear research and control, visual training, and security measures.

Dropping prices of industrial TV have spurred sales. Whereas the average installation used to cost around $10,000, the price is now from $1,500 to $5,000. Sales volume in 1955 was $4 million, a 400 per cent increase over 1952. Estimates of the 1956 sales volume range from $6 million to $10 million.

Although security restrictions make it difficult to deal in specifics when talking about military electronic applications, it can be said that there is no military arm or branch of service which has not benefited from the use of electronics.

Of course, the basic foot soldier must still depend on his rifle, but even his rifle and ammunition are made more accurate and reliable through electronic control and testing devices used by the manufacturer. And the GI of the future will probably be able to gripe because the food prepared on electronic stoves doesn't taste like his mom's cooking.

The air at the Pentagon is filled with a new jargon: LORAN, TACAN, DEW Line, Texas Towers. None of these would be possible in their present state of effectiveness without electronic components. As an example, let's take the case of the fighter plane. Ten years ago our fighters

(*Continued on page 77*)

The Navy's Role in the Development of Radio

by Captain Gordon L. Caswell, USN

The USS Iowa, shown maneuvering but unmanned before being sent to the bottom, was equipped for radio control and, in Panama Bay in 1923, was the first radio controlled ship to be sunk in gunnery practice. The Navy's early projects in the development of radio control involved aircraft and topedoes as well as ships. From these beginnings came today's guided missiles.

ON JULY 14TH OF THIS YEAR I ATtended a nostalgic ceremony in Arlington, Virginia, which marked the closing of "Radio Arlington," better known to old-time radio operators and radio amateurs throughout the world as NAA. This station had been in continuous operation for 43 years, and was the Navy's and the world's first modern, high-power radio station. I also observed, not so very long ago, the take-off of a guided missile which depended upon radio waves for its successful flight to the target. With the latter event following closely behind the former, the thought came to me, "What remarkable developments have taken place in the use of radio in the short span of less than half a century!"

Radio, which was only *one* thing not so many years ago, is now many things. Unlike the man who tries to be all things to all people and fails, radio has actually become many things to all people. "Radio" is now so universal in its almost infinite application that it seems to be nearly forgotten how very *new* radio still is; and whereas I think it is generally recognized that the U. S. Navy had a predominant part in the development of radio in the United States, it is probably not generally realized to what extent this Nation is indebted to the Navy's pioneering and continuing efforts in the development of radio.

It may be stated with considerable accuracy that the history of radio development in the United States Navy is also the history of radio development throughout the world. The Navy's role in the development of radio communications equipment and techniques, bracketing voice broadcasting, remote control of ships, as targets, which led to the guidance of missiles, the pioneering of radio controlled aircraft known as "drones," the conduct of radio communications within the United States and throughout the world, the allocation of radio frequencies among nations, the formation of the Radio Corporation of America, the Navy's assistance to what is now known as the Federal Communications Commission, the elimination of foreign radio operations from United States soil—all of these things are probably not general knowledge.

Navy's Interest in Radio

The motivation for the U. S. Navy's official interest in radio is obvious. For centuries the navies of the world depended upon communications within visual range. The Navy reasoned: If radio were feasible, radio signals could penetrate darkness or fog, and bridge great distances, and its adaption and development would accom-

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The Author

Captain Caswell, Assistant Director of Naval Communications since July, 1954 has had a long, varied career in Naval communications, both in combat and administrative areas.

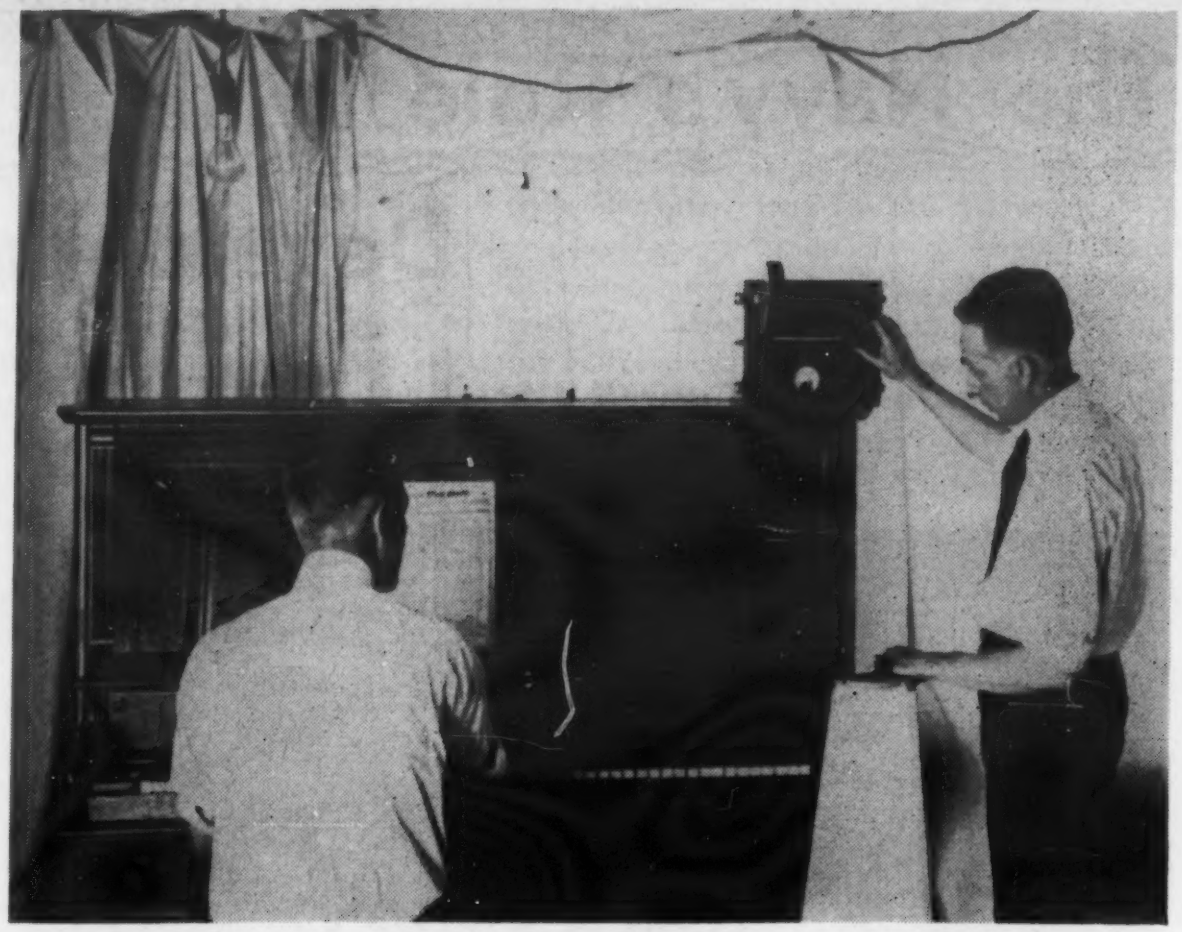
plish a new era in sea power, through coordination in the movement and action of widely dispersed units.

The United States Navy was in the game so early that Navy interest in radio at least coincided with, if not preceded, Marconi. Guglielmo Marconi was issued his first patent for a wireless communications device on 2 June 1896. A document in the possession of the late Professor Amos A. Dolbear, of Tufts College, attests to the successful experiments in shipboard radio of Lieutenant Bradley A. Fiske, USN, later Rear Admiral, prior to 31 August 1888. According to that evidence, RAdm. Fiske, as a Lieutenant, "wound a number of turns of insulated cable around the *USS Newark* lying at the New York Navy Yard, and likewise around the Navy Yard tug." He sent interrupted current to the *Newark's* coils and listened on the tug with a telephone receiver in series with the coil system. Said this Navy officer, "I could get signals a short distance away . . ." In 1888, the year of the Fiske document, Marconi was a teen-age boy of 14 years. Marconi's patent was issued eight years later.

Whereas RAdm. Fiske made the United States Navy his profession, Marconi made "wireless" his, and following Marconi's successful establishment of wireless communications across Bristol Channel in England, and between the Royal Palace at Rome and the Italian cruiser *San Martin*, both in the year 1897, the U. S. Navy and Marconi got together in the United States.

First Official Message

It was on 30 September 1899 that the first official Navy message was sent via wireless telegraph, with Marconi as operator. This message read, "Bureau of Equipment, Washington, D. C., from steamship *Conce* underway in naval parade via NAVESINK Station. Mr. Marconi succeeded in opening wireless telegraphic communication with shore at 12:34 p.m. The experiments were a complete success. Signed Blish Lieutenant, USN." The transmission was accomplished during a naval parade in honor of Admiral Dewey who had just returned from his memorable victory in Manila Bay. The message was sent from the *Conce* to the Highland Station on the Jersey coast.



The Navy's Broadcasting Station NSF, which began broadcasting in 1920, was the first in the Nation's Capital and one of the first in North America. As a pioneer in the disk jockey field, this Navy station received requests from listeners in 28 states. Mr. Leo C. Young, standing, now an Electronic Consultant at the Naval Research Laboratory, and formerly Associate Superintendent, is seen checking the signal modulation through the monitor, in 1921. Mr. Raymond B. Meyer, deceased, is seated.

From that experience with radiotelegraphy, it was evident to a Navy observer present that the Marines who had recently fought at Guantanamo Bay, Cuba, the previous year could have directed the fire of Navy guns on the enemy, lessening the danger to American forces and increasing the effectiveness of Navy fire, if the Navy and the Marines had been able to use radiotelegraphy at Guantanamo. The fighting in Cuba was now over, but two great wars were in America's future, the first to come only twenty years later. The Navy recognized radio as a new weapons system and applied it to ships of war.

Before the turn of the century, the Navy invited Dr. Marconi to apply his new wireless telegraph system to the *USS New York*, *Massachusetts*, and *Porter*. By 1916, the Secretary of the Navy, Josephus Daniels, was talking from his desk in Washington, D. C., with a moving offshore ship of the Fleet by telephone! But already, in 1901, the United States Navy had outfitted all of its major ships with German-made communications equipment, and in 1902 had purchased, in addition to Slaby-Arco and Braun-Siemens-Halske equipment from the Germans, a set designed by Rochefort and Ducretet of France, and a Lodge-Muirhead from the English. From within the United States itself, the Navy purchased de Forest equipment and quenched gap sets of American design, including the Lowenstein gap, Simon sets, and others. A few years later, the United States would be self-sufficient, but in the beginning the Navy sought the best equipment the world provided, regardless of country of origin, until the best, or equipment equal to the best, came from within the United States.

The Navy knew that the Age of Radio had arrived; that radio was a formidable new weapon which should be developed to its maximum utility; that future wars would be fought differently from past wars; that if nothing else would make them different, radio alone would.

Radio Underestimated

Now, almost single-handledly, the Navy proceeded with the development of radio while skeptics (and many of these were high-ranking naval officers) laughed and many others totally underestimated the potential of an invisible radio wave. However, the Navy's exponents of radio (and many were junior officers) pressured policy making officers and American business alike, into the

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History was made in May, 1916, when Secretary of the Navy Josephus Daniels, shown here with AT&T officials, talked by radiotelephone from his office in the old State, War, and Navy Department Building at Washington, D. C., with a moving ship, the USS Nebraska, off the Virginia Capes. Other tests in the fall of 1916 were made from Secretary Daniels' office to the Captain of the USS New Hampshire, cruising between Hampton Roads and the southern drill grounds.

gathering flood-tide of the new science.

By 1908, one-half of all the "wireless" stations in the world were operated by Navy personnel, such was the world leadership of the Navy in the new science of radio communications. By 1908, also, the Navy had established the United States Navy Radio Laboratory (predecessor of the Naval Research Laboratory) to conduct radio communications research.

While many others were just awakening to the possibilities of radiotelephony, the Navy was active in aiding its development. In 1906 Navy tests with the Poulsen type modulated arc transmitter were made on a number of ships; and by 1909 the *Connecticut* and *Virginia* were equipped with "wireless" *telephone* equipment for experimental use during the world cruise of the old White Fleet.

Radiotelephony actually came of age in 1915, when NAA, together with the French in the Eiffel Tower at Paris, succeeded in completing the first trans-oceanic radio-telephone circuit in history. This was followed by similar unprecedented overseas voice transmissions by the Navy from Virginia to the Hawaiian Islands. In the successful operation of this pioneer radiotelephony, the Navy, Dr. Lee de Forest, and Bell Telephone engineers all collaborated.

Tests in the fall of 1916 were carried out from Secretary Daniels' office in the Navy Department to the Captain of *USS New Hampshire,* cruising between Hampton Roads and the southern drill grounds. The Commandant at Mare Island Navy Yard also took part in these conversations with the *New Hampshire's* Captain, using land lines from Mare Island to Arlington, thence by radio to the *New Hampshire.*

World Wide Communications System

Less than two years later and before World War I ended, the Navy had in operation the most extensive radio system in the world. The Navy radio communications system had progressed to such a point that it not only handled messages of the United States Naval forces on the seas, but also those between the War Department and the American Expeditionary Forces in France.

In this same period, 1917, the Navy developed the radio beacon, and made the first such installation at Point Judith, Rhode Island.

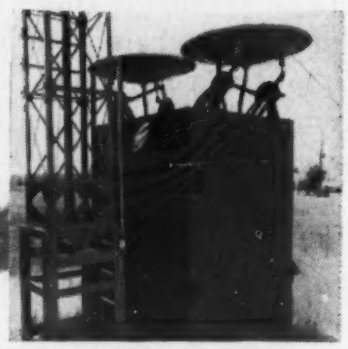
It was also from the antennas of the Naval Radio Station at New Brunswick, New Jersey, that President Woodrow Wilson's historic "Fourteen Points" were transmitted from the United States and received at Nauen, Germany; and it was by the Navy radio station at Otter Cliffs, Bar Harbor, Maine, at 2100 on the night of 6 October 1918, that the first German Peace Note was received from Nauen, which was followed by the Navy's receiving the second German Peace Note at 1542 on 12 October 1918.

Such was the lack of law and regulations affecting radio in the United States prior to World War I that the United States was tantamount to a newly discovered continent without statutes, and subject to prey by either friend or foe for the national betterment or detriment, so far as radio communications were concerned. In short, the United States was "wide open" for communications exploitation by anyone. Consequently, the United States had what today would be illegal radio operations, not necessarily in the national interest, in its midst. Foreign countries and foreign business interests had radio stations operating within the continental United States, and one prominent "American" radio company was financed with foreign capital, and as for cable, the British controlled every mile. From within, the national security could easily be impaired, and from without, the United States was

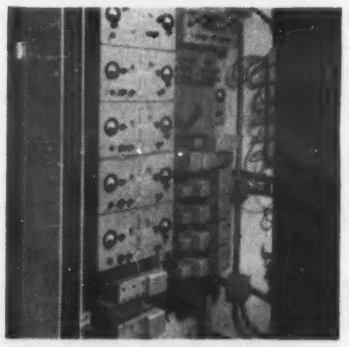
The Navy was the first to broadcast the voice of a President of the United States. This "communications-first" took place when Warren G. Harding spoke at the dedication of the Lincoln Memorial. The microphone, subtly boxed in white to match the marble columns and steps, can be seen on the microphone stump stand about four feet in front of the late President Harding. The Navy also made the first broadcast of a presidential message to Congress—that of President Harding—in December, 1922.

MICROWAVE *AIRLIFT...*

Transportable 800 lb. Magnesium antenna mast telescopes to 100 ft. Trained crew of 8 men can erect mast in less than an hour.



Microwave System capabilities include the transmission of voice communications (up to 72 two-way channels), radar data and radar control functions.



Transportable Packages Grow into Miles of Communications in 2 Hours

A microwave station that can be transported to a site by helicopter and then put into operation in as little as two hours has been developed by Motorola for the U.S. Air Force. The equipment was designed to satisfy Air Force requirements for high information handling capacity, transportability, and quick installation.

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dependent for international communications, as were all other nations, on the British. The Navy now took the lead in eliminating foreign radio operations from its shores and setting up a wholly U. S.-owned international radio communications company.

The Navy learned that negotiations were underway between the British Marconi Radio, through American Marconi Radio, and the General Electric Company, for the purchase of Alexanderson alternators for the British Imperial Wireless Chain, which was world-wide, and also for certain radio patents held by the General Electric Company. The Navy realized that if the negotiations succeeded, the British would control world radio in addition to world cables.

On April 8, 1919, Navy representatives called on General Electric at a special meeting of the Board of Directors, and presented their views on the consequences to the United States of consummating such a deal as General Electric then had under consideration. General Electric decided to discontinue negotiations. The Navy then proposed the formation of a wholly U. S.-owned radio communications company, and eventually the Radio Corporation of America was formed to fulfill this need. Foreign interests were bought out and their radio operations on American soil thus dissolved.

Navy Aids in Negotiations

When traffic agreements between the new RCA and European countries were being negotiated, the Navy went to RCA's aid with the lone European hold-out, France, which opposed the licensing of "private" commercial companies to communicate with foreign countries. In France, the American position was discussed in private between a Navy representative and the French Director of Postal Telegraph. Following this meeting with the Navy representative, the French Director informed the president of RCA that the French had granted a license for the government-owned radio and telegraph of France to communicate directly with the RCA stations in the United States.

By 1919, the Navy was successfully transmitting radio voice communications from air to ground and ground to air, and a year later, radio *voice* communications were successfully exchanged between a U. S. Navy flying

The Radio Corporation of America evolved directly from Cdr. Stanley C. Hooper, later Rear Admiral. The proposal for a wholly U. S.-owned radio communications company resulted in RCA and the riddance of foreign radio companies from the U. S.

boat and a partially submerged submarine, an accomplishment of great importance to the future operations of the Navy.

As for radio broadcasting, the Navy's broadcasting station at Anacostia was the first broadcasting station in the Nation's Capital, and, except for very early experiments of Dr. Lee de Forest, was one of the very first broadcasting stations in the United States. *This Navy station was such a pioneer in the history of broadcasting that its last important broadcast was the first broadcast in history of the President's message to Congress, that of Warren G. Harding in early December, 1922.* This historic "first" was sent out on a multiple tuned antenna, with an input of about 1 kilowatt, on a frequency of approximately 700 kilocycles.

The Navy's early projects in the development of radio control led to radio controlled target ships. The *Iowa* was equipped for radio control in 1923 and was soon followed by a destroyer which was similarly equipped. These ships were, of course, used as targets for gunnery practice in the Fleet. The Navy had already begun work about this time on pilotless target aircraft known as "drones," and in the next year, 1924, radio remote control of aircraft was successfully accomplished.

The Navy also contributed to the U. S. efforts to obtain international agreement to the allocation of frequencies. After the close of World War I, the EUFGBI committee was organized, consisting of representatives of the United States, France, Great Britain, and Italy. The committee established the first international radio frequency plan for inter-allied communications with a minimum of radio interference. Methods and procedures for maintaining radio communications were also established internationally. Remaining as unfinished business was a world-wide plan for international radio communications.

In 1920, representatives of the Allied and associated powers met for the purpose of drafting an international communications convention of all the interested nations of the world. At this preliminary conference, with RAdm. W. H. G. Bullard, USN, as chairman, and Cdr. Stanley C. Hooper, USN, as his assistant, an agreement was reached for an international radio convention which, for the first time in history, would consider a plan for allocating radio frequencies on a world-wide basis. The formal and final conference took place in 1927.

By 1927, developments in radio had made obsolete the recommendations of 1920. For one thing, the mushrooming of radio broadcasting between 1920 and 1925 increased demands on the spectrum, with the result that Secretary of Commerce Herbert Hoover called several national radio conferences, at which the Navy representatives were very influential. To meet this problem and aid the U. S. in its negotiations, the Navy recommendation that gave both the Government and commercial interests their own bands carried over much opposition. The Navy recommendation meant a sacrifice of its own slice of the spectrum, but the growth of private industry broadcasting was fostered, with a profound economic effect upon the Nation. Former opposition to the accepted Navy proposal soon turned into approbation and the Navy's foresight was applauded.

Navy Allocation Plan

At the International Radio Convention of 1927, the Navy offered what appeared to be the only plan for frequency allocation that existed on paper, other representatives being seemingly indefinite in concept. The Navy, always motivated by its intention to be able to go almost anywhere on the seas and maintain communications with the home base and other Navy

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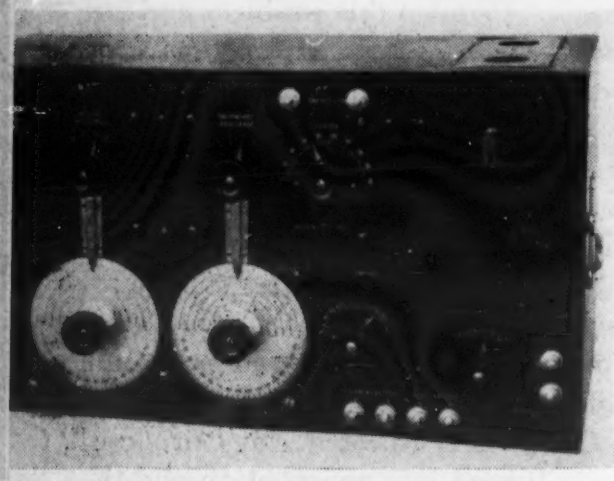
ships wherever located, also sought orderliness in international communications which only a practical frequency allocation plan could effect. The Navy had both the radio experience and the frequency plan, which accommodated every known radio service, including amateur radio. The frequency allocation of the United States Navy was adopted, first by the Allocation Committee, then by the entire conference, and finally by all of the nations of the world, except one. The lone exception was the USSR.

Navy Spurs World Radio

World radio was spurred by this historic landmark in communications, to say nothing of the benefits of the Allocation Plan to the Merchant Marine and American amateur radio operators, in whose behalf the United States Navy persisted. The Navy then, as now, considered amateur radio operators an invaluable technical and development reservoir in the national interest. The Navy allocation concept still forms the basis of frequency assignments throughout the world.

The Navy's building blocks to aid in the formation of our present age of radio are so numerous that an article of this nature cannot possibly contain them all. For instance, the Navy had an important part in the first propagation studies ever made, and out of them emerged the Austin-Cohen formula. Although the knowledge that exists on the subject of radio propagation today is universal, at the time of the studies and tests, utilizing Navy ships and Navy personnel under Dr. L. W. Austin and George H. Clark, almost no information on the subject was in existence. It was a Navy enlisted man who first pointed to the influence of "sunspots" on radio communications. At that time mankind did not know that radio communications, and particularly long-range communications, are vitally affected by the sunspot cycle; today this is common knowledge. At the time, however, it was another foundation stone.



The Navy made and installed the first radio set to go into the White House. Made at the Washington Navy Yard, it was installed for President and Mrs. Harding in 1921. The President's acceptance of radio, and his use of headphones, spurred public acceptance of the medium and helped cause a boom in the manufacture of headphones which were soon replaced by loudspeakers. Shown here is the identical model, "Radio Compass Receiver Type SE 1440A." This set had a range of 125 to 1250 meters, using either an antenna or a compass loop, and could be used with either a loudspeaker or headphones.

Today it means little or nothing, perhaps, that our radio stations were once called "wireless stations," which are now designated as "radio stations." The United States Navy was the first to adopt the novel term by designating NAA a Navy "radio station." The Navy term has since been adopted by the entire communications industry.

It would not be fair to mention Marconi without also mentioning Dr. Lee de Forest and something of his early work with the Navy which had momentous results on all radio communications. The Navy and Dr. de Forest were "associates" for many years during the early period. For example, when President Thedore Roosevelt sent the Great White Fleet around the world on an international goodwill mission, Dr. Lee de Forest, the "father of radio broadcasting," was on board the battleship *Connecticut,* flagship of the Fleet. Employing equipment utilizing his new vacuum tubes, Dr. de Forest supervised one of the first successful tests of the wireless telephone between the *Connecticut* and the Naval Radio Station at Point Loma, California, and what we know as "radio broadcasting," or the transmission of voice by radio, was in part being born.

First Remote Control Radio Station

Less than a decade later, the world's first remotely controlled radio station was installed and operated by the United States Navy in Washington, D. C.; and of lighter vein, one of the very earliest automobile radios was developed by personnel of the Naval Research Laboratory.

The Navy was also the first to broadcast the voice of a President of the United States, that of Warren G. Harding, during the dedication of the Lincoln Memorial, and at this time, the Navy also installed the first radio receiving set in the White House.

The Navy was one of the earliest users of the very low frequencies, which are of the same frequency as high frequency sound waves. Today extensive use is made of these frequencies for long range transmissions to surface ships and submerged submarines. Our newest very low frequency transmitter is at Jim Creek, in the State of Washington, and is the most powerful radio station of its kind in the world. The vacuum tube power amplifier of this station, built by RCA, is also, to put it another way, the world's most powerful Hi-Fi amplifier.

Experiments in Facsimile

In the early 1920's, personnel of the Navy were already investigating and testing facsimile equipment, and in 1923, recognizable pictures of President Harding were transmitted by the Navy from Washington, D. C. to Philadelphia, Pa. Twenty-two years later, photographs of the Japanese surrender ceremonies aboard the *USS Missouri* were transmitted by the Navy more than 5,000 miles to the United States and the Nation's press. Today, weather maps and other valuable pictorial data are transmitted thousands of miles for the benefit of the Navy and public alike.

In summary, I should not want this article to appear that I am claiming for the Navy credit for everything in the development of radio, for such is definitely not the case. Great as the Navy's role has been in this important field, vital contributions have been made by our sister services, by industry, and by many individuals. A true history of the development of radio will include them all.

The Navy does, however, hope to participate in the continued development of radio in the present era as it has in the past, and welcomes the wide participation of all interests now equally active in this field.

automatic fire control

by Reeves INSTRUMENT CORPORATION

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Our Developing Military Strength

A Scientist's View

by Dr. Mervin J. Kelly

NEARLY 50 YEARS AGO, WILLIAM JAMES HAD AN UNCANNY perspective of things to come. At a time when warfare and applications of science were poles apart, he said, "When nations are the armies, and the science of destruction vies in intellectual refinement with the sciences of production, I see that war becomes absurd and impossible, from its own monstrosity."

The time that he predicted has certainly arrived. Science and warfare are intimately intermingled. In fact, the strategy, tactics and defense areas of warfare are wholly dependent upon applications of scientific knowledge. If we are to stay ahead in military strength, we must lead in the applications of new science to weaponry.

All knowledgeable people of the world realize that there are great dangers of global suicide latent in the use of the nuclear weapons that are now in the stockpiles. The danger of their use, however, though real, is fortunately not great, for the damage to the aggressor in attempting a knockout blow would be comparable to that he would inflict on his enemy. Churchill has aptly called this type of limited security a "balance of terror."

It is perhaps only through the maintenance of superior military strength that we can buy time for peaceful accommodation of the world's differences. Until such an accommodation is possible, it is our responsibility, as the strongest Nation of the free world, to continue to build our military strength as the best protection for the democratic freedoms of the western world that have evolved through centuries of struggle.

Nuclear Weapons Development

Nuclear weapons, of course, are the product of scientific research. Their evolution, in a period of some 12 years since the first ones were used in Japan over Nagasaki and Hiroshima, has made a greater imprint on warfare and changed its character more than all of the developments of the previous 200 years.

The Hiroshima weapon had an explosive power equivalent to 20 kilotons of the old chemical explosive. Our present largest fission-type nuclear weapon has a 1,000 kilotons equivalence — a 50-fold increase over the first ones employed in warfare. In addition to our progress in increasing the destructive power of the fission weapons, much progress has been made in their deliverability. The ratios of explosive power of the nuclear weapons to their total weight and size have steadily increased. This has made possible the employment of an even greater variety of weapons carriers, as well as an increase in the amount of destructive power that each carrier may deliver.

In relatively recent years, weapons development has entered a new area of nuclear physics—that of fusion. Our recent so-called thermonuclear weapons employ both nuclear fusion and fission reactions. In tests at our Pacific proving grounds, one of these thermonuclear weapons is reported to have demonstrated an explosive power of some 20,000 kilotons—20 times as powerful as the largest of the fission types.

Russians Trail in Nuclear Weapons

While great progress has been made in increasing the destructive power of the largest nuclear weapons, new technology is making possible an increasingly wide variety of nuclear weapons that are smaller in explosive power, physical size, and weight.

We are fast approaching the day when a nuclear weapon of a wide range in explosive power can be designed in shape, size, and weight to meet the requirements for delivery by any desired delivery system.

The Russians are trailing us in nuclear weapons by a considerable distance. This is, perhaps, the area of military strength in which our lead is most pronounced. Their nuclear explosion of greatest power that has been observed was perhaps less than one-fifth that of our greatest. There is sound basis for the judgment that they are also less advanced than we in versatility and that their stockpile is smaller.

Next, let's review our progress in developing means for delivering nuclear weapons. First, we shall direct our attention to the strategic area. This is broadly the area of warfare dedicated to the destruction of the enemy's war-

(*Continued on page* 28)

The Author

Dr. Mervin J. Kelly, president of Bell Telephone Laboratories, has had broad experience in directing research and development programs including military projects.

In 1952, the Secretary of Defense appointed him chairman of a committee to study the Nation's continental defense.

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making potential: his factories, his transportation systems, and his airfields. For delivery, we have largely depended on home-based bombers: intercontinental with refueling, bombers of shorter range flying from our bases in Europe and Asia, and bombers flown from the decks of the Navy carriers. All of these airborne carriers can deliver nuclear weapons of millions of tons explosive power equivalence.

Ballistic Missile is Future Weapon

For the future, there are now under development two new types of vehicles that will add to the versatility and effectiveness of our delivery of nuclear blasts in the strategic sector of warfare: the ballistic guided missile and the nuclear-powered manned airplane. The ballistic missile may well become operational within the next three years. The nuclear-powered plane will be longer in coming, probably not until well beyond 1960.

Ballistic missiles are propelled into the upper atmosphere by powerful multistage "engines" that are successively dropped as they complete their delivery of "thrust." In the upper atmosphere, they proceed at terrific speeds, many times the velocity of sound, and are placed on target through guidance that is provided in the early portion of their flight. The range of such missiles may well be 5,000 miles; they may thus be launched from sites in our country and reach any target in Eastern Europe in less than one hour. Such a 5,000-mile, or intercontinental ballistic missile (I.C.B.M.), is under development. A 1,500-mile ballistic missile is also being developed. Its range is suited to launching from our overseas bases or from missile-carrying cruisers at sea.

The ballistic weapons, when developed to the level of accuracy that now appears attainable, will fall within a circle of a few miles' radius whose center is the target. They can carry warheads whose nuclear explosive value is the equivalent of millions of tons of the older chemical explosives. With their potential accuracy and explosive carrying capacity, great damage can be inflicted upon strategic targets. While the ballistic missile will be a most valuable addition to our weapons supply, it is not, or at least will not be for a decade or more, the so-called "ultimate" weapon. For a long time to come, we must rely for the most part on manned bomber planes for strategic area victory.

While some years must elapse before it is ready for operational use, the nuclear-powered airplane has large importance. Nuclear power permits the plane to cruise for time intervals limited only by crew endurance. No refueling in flight is required. With its long time aloft, it could penetrate at any point along the periphery of enemy territory. This adds to the versatility of our attack and greatly increases the enemy's defense problems. While there are major technical problems that must yet be solved, there is a large volume of competent scientific and technical effort directed at their solution.

The Navy adds greatly to our strategic warfare strength. The larger aircraft carriers of the *Forrestal* class will make it possible for the Navy to launch from carrier decks planes capable of carrying million-ton nuclear bombs. Since there are such large areas of ocean and sea that can be entered by our carriers, this capability will also add to the versatility of our attack. Submarines may also contribute to strategic warfare. Already guided missiles carrying relatively large nuclear bombs can be launched from submarines. They can approach close to land in launching their missiles. Many sectors of possible enemy territory are open to them. A submarine, driven by atomic or nuclear power, is now undergoing operational tests; additional ones will follow. Nuclear power also adds cruising range to the submarine and greatly increases the length of time in which it can stay submerged. Before too many years, vital elements of our surface fleet will also, no doubt, be equipped with atomic engines.

We are well in the lead of the Russians in strategic warfare taken as a whole. In nuclear weapons our lead is perhaps most pronounced. In quantity of weapons, in variety of types, and in largest size, we lead. In air delivery we are also now in the lead. The "figures of merit" of Soviet bomber planes, however, are approaching those of our most recent bombers. Our versatility in delivery, however, is superior. In intercontinental delivery, in delivery from bases close at hand, and in delivery by the Navy from carrier based planes and submarines, the leadership is ours. It is a narrowing leadership and perhaps that is inevitable. In production of new and most modern bomber airplanes, the Russians are probably outproducing us. In time, their capability of delivery, as measured by number of delivery vehicles, may surpass our own unless our production rates are increased.

In ballistic weapons development, the Russians are perhaps now in the lead. Until relatively recently, our missile development has been heavily oriented towards "conventional" intercontinental missiles and missiles for the tactical and defense areas. Our emphasis in these areas has given us important supremacy there, and a rich technology upon which to draw in our ballistic weapons development. With the emphasis now given to ballistic weapons development and with our technical superiority, it is not probable that the Russians will have a significant ballistic weapons stockpile before we do.

Growth of Nuclear Technology

As nuclear technology has grown in depth and scope, our nuclear weapons research and development has given increasing attention to smaller weapons, of smaller explosive power for the tactical and defense areas. This effort has been most rewarding, particularly in the short time range, in its contribution to building a strong deterrent potential in Europe. Cannons, rockets, guided missiles of a few hundred miles' range, and tactical planes have been equipped with relatively small explosive power nuclear weapons. These weapons are now available to our forces in Western Europe and go a long way in compensating for our much smaller ground force strength.

As new knowledge of nuclear application to weaponry has become available, new nuclear tactical weapons systems have been promptly developed until today, almost the entire gamut of tactical warfare may have nuclear fire power. Even though relatively small in nuclear power terms, the destructive force of these new weapons is so great in comparison to the former chemical explosives that completely new tactics, force organization, and deployment have been required.

In tactical applications of nuclear energy we have been

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well in the lead of the Russians. The versatility of our nuclear weapons has made possible this superiority. It is to be expected, however, that with their increasing nuclear capability the Russians will narrow our lead in the tactical area.

Defense against nuclear attack—popularly called "continental defense"—is an essential complement to our developing attack strength. In late 1952 and early 1953, I was chairman of a civilian committee appointed by the Secretary of Defense to study our continental defense and recommend further action for its strengthening. We found defense lagging behind offense. Too little effort was employed and there was not a well integrated plan for most effective participation of the three forces. It is most pleasing to report very great progress in the ensuing three years. There is evolving a defense system that is well in balance with offense. The planning is such that as technology provides better means, they can be integrated in the existing system.

Early Warning Lines are Key to Defense

The first step in continental defense is a means for our early warning of enemy plane and missile approach. The extreme or outer early warning line to the north is the DEW Line (Distant Early Warning) along the Arctic Circle. Our Canadian friends are installing a somewhat similar warning line along a parallel just south of the lower tip of Hudson Bay. It may later be expanded into a fighting line.

There is a growing "wing" early warning line to the east and west of the DEW Line extending south in the Atlantic and Pacific. In the main, these wings will consist of picket ships equipped with early warning gear and large patrol planes well instrumented with the most advanced early warning electronic facilities.

With the warning time that these lines afford, our defenses can be alerted and ready for action when the enemy reaches our boundaries. Canada has a growing fighting defense net in its lower or southern areas. In the north of our country and extending southward along our two coasts is our defense fighting line. A most sophisticated and integrated electronic fight direction system called SAGE (Semi-Automatic Ground Environment system) is evolving. This system provides for picking up and tracking by radar and other means the oncoming enemy planes and missiles. It also directs, electronically, our fighter planes or guided missiles to the targets. Some of its radars for picking up the enemy and directing our weapons to them are placed in the ocean on steel towers (Texas Towers) at short distances off our shores.

Our cities and important military installations have individual protection. The Nike guided missile and interceptor planes constitute our "defense forces" at these points. All of these defense facilities—early warning, the SAGE system, and point defenses—are integrated by a comprehensive communications system. An overall continental defense headquarters is constantly and promptly aware of the situation at all points of our early warning and defense systems.

Many of these detection and fight direction systems are dependent upon radio emanations for their effective functioning. An enemy may use "electronic jamming" of electro-magnetic radiations to lower the effectiveness of the system. Large advances have been made and will continue to be made to minimize the effects of "jamming."

The Russians have given great emphasis to their own defense. For geographic reasons their problem is the more difficult. As of today, it is my belief that our overall system and many of its components—such as guided missiles and their fire power—are in advance of the Russians. The Russians are known to be particularly skilled in jamming techniques. An exact measure of the relative position here cannot be made, but their competence must not be underestimated.

Defense against ballistic missiles, because of the altitude at which they approach and their terrific speeds, poses a most difficult but not impossible challenge in defense. It is too early to predict how effective such defense may ultimately become. However, there is some basis for hope from the history of the developing technology for defense against planes and "conventional" flight missiles. Only a few years ago most of those who are expert in these matters would not have predicted the really large progress in defense that has been realized.

Finally, we will take a brief look at our developing naval capabilities in nuclear warfare. Along with the other two Services, the Navy has promptly and vigorously integrated nuclear weaponry into its strategy and tactics of warfare. The naval air arm is making splendid progress in its utilization. Nuclear explosives of million-ton power can be carried by carrier based planes; fleets can be protected by guided missiles capable of carrying nuclear warheads; cruisers especially fitted for nuclear weapons attack are in evolution, and our submarines can use nuclear fire power.

We closed the last war with the strongest Navy, by far, of all nations. The Russians had little naval strength. They, however, have been carrying out a tremendous naval construction program. Submarines have been given special emphasis in this program. So far as I know, they have not built carriers—certainly carriers have not been given emphasis. On the other hand, our construction and modernization program has been most modest in its volume, but not in its technology. This difference in construction and modernization level must, for our long range future welfare, receive special consideration and evaluation. I have no doubt that this is being done. The application of nuclear power to propulsion of naval vehicles has received much effective attention. We are well in advance of the Russians in this area.

Summary of Strength

An overall summary of relative American and Russian strength gives justification for short term comfort but long term concern. Our nuclear war potential is certainly now greater than that of the Russians. We are technologicaly well ahead in many areas; they are close to us in some—aircraft, for example. They may, for the moment, be in advance of us in ballistic missiles development. If this be the case, it is only due to their earlier application of large effort. With our expanding effort, this should be a temporary situation.

When one compares quantities and rates of production of nuclear weaponry delivery systems, the picture is not so

(*Continued on page 77*)

A SIGNAL CORPS SALUTE

by Maj. Gen. James D. O'Connell, USA

IT WOULD BE INTERESTING AND instructive if we could recreate the sense of the times ten years ago when SIGNAL, as "SIGNALS," was launched. It was not the most opportune period for starting a new military association. As the aftermath of World War II, the Nation was optimistically and rapidly dismantling its military forces and seeking an all-out return to the pleasures of peace and prosperity. The Armed Services were being readjusted to the lowest possible level and military budgets were gone over with a fine-tooth comb.

With an understanding of such a background, we can pay proper tribute to the pioneering and successful efforts of men like General H. C. Ingles, General David Sarnoff, and many others in establishing the forerunner of the present AFCEA and the SIGNAL publication. These men represented and anticipated the growth and contribution of the communications and electronics industries to our Nation and the establishment of the military-industrial team for national defense.

Research and Development Had Top Priority

I believe it important to appreciate one other important factor that was manifest ten years ago. While the military services were adjusting to an austere operating level and preparing to live for a long time off the stockpile and roll-up of World War II materiel, the fateful step was taken of placing the highest priority and a large share of the limited funds in an aggressive scientific research and development program, to which the Congress gave its constant support. This was particularly true in the communications and electronics fields. Today's advanced weapons and systems, such as guided missiles, aviation electronics, high capacity communications, radically improved radar, and many automation devices, are products of the wise decisions and the investment in our research and development started ten years ago.

Great Challenges in National Defense

When we look at today's circumstances, notwithstanding the characterization of this period as the "Age of Electronics," we have little reason to be complacent or satisfied. While the Nation stands at its greatest peak of prosperity and its highest standard of living, the success of our economy will depend upon our continually developing and distributing new products and services of which electronics will have a major share. This maintenance of a stable and prosperous American economy is not important solely to provide for the welfare of the American people, but is actually a major factor in maintaining peace and security and for preserving a strong free world.

In the area of national defense, the Armed Services today are faced with greater challenges than at any time in their histoy. We are still confronted with implacable exponents of militant Communism who are continuously increasing their strength and in no way, indicate any significant changes in their announced policy of domination and conquest by any or all means. In this regard the Soviets and their satellites have continually demonstrated their intent and adroit and flexible capability to exploit any form or combination of warfare and political infiltration to enhance their interests and policies. Our national defense, therefore, requires an unprecedented degree of flexibility to face the prospects of future conflict. The Armed Services have to be prepared to fight any kind of war, in any place on the face of the earth, with conventional or atomic weapons. We must have sufficient strength in being to deter aggression or quickly to contain and eliminate local conflicts or small wars before they blossom into major catastrophes.

Basic Military Objectives

Basic objectives of the military services are to maintain a high degree of flexible combat readiness and to provide major increases in new combat capabilities. In both of these objectives, communications and electronics are essential factors. Combat readiness cannot exist unless the com-

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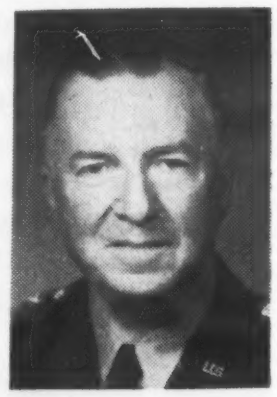
The Author



General O'Connell, a national vice president of the AFCEA, as Chief Signal Officer, USA, has been a noted leader in the communications field.

mander has instantaneous and reliable means of communications to control his forces and to obtain timely intelligence on the enemy's action and capabilities.

Improving Combat Capabilities

We already have witnessed the contribution of communications and electronics to improving the combat capabilities of the Nation in the many new weapons systems which are being developed and employed by the Army, Navy, and Air Force. However, what we have accomplished is not enough —by far not enough. There are many significant technical challenges that are facing the communications and electronic sciences and industries right now. Perhaps the foremost of all is the exploitation of electronic means for target acquisition or battle area surveillance.

It is apparent that the new weapons systems and augmented firepower have to be matched with equivalent capabilities for quickly determining proper targets, for use of our new weapons at far greater speeds and accuracy than is currently available. Such a surveillance system includes the acquisition and assimilation of vast amounts of combat data and the means to quickly assess the results of our firepower.

Another major technical challenge is to provide an orderly scheme for managing our increasingly complex electronics environment in which our combat forces need to operate. The density of electronics and communications gear in the field poses critical problems of frequency control and mutual interference. The growing employment of systems utilizing electromagnetic radiation increases the problems of the vulnerability of our equipment to deliberate interference. The means to insure the reliability of our systems in the face of enemy interference, as well as the development of suitable counter-countermeasures, is one problem of major importance to the electronic scientist and engineer of today.

The most important challenge of all facing this Association and the Nation today is the ever-growing shortage of scientific, engineering, and technical personnel to support our present capabilities and requirements, and to advance the communications-electronics sciences to our future needs. I'm not going to belabor this subject, because it has been thoroughly aired in public, in the Congress, and by many professional and scientific associations, including AFCEA. The attack on the personnel problem is one which will have to be sustained on many fronts, including our public education system, salary and other incentives, support of the high schools and universities by industry and scientific institutions, and proper utilization of professional skills, to name a few.

In looking ahead for the next ten years for SIGNAL and the AFCEA, I think we can gain some valuable lessons from our review of the first ten years. In some respects, today's circumstances are parallel to conditions in 1946. An over-optimistic interpretation of the conditions of the security of the Nation and the world, and an unbalanced preoccupation with satisfying our material needs could jeopardize the prosperity and security of the Nation. Fortunately such attitudes do not appear likely. Again, the Armed Forces require the full output of creative thinking and contribution of the electronics and communications industries and sciences to improve our combat readiness and to insure the superiority of our forces for the future.

Greater Service to the Nation

The industry team in communications, electronics, and photography, which has been so patriotically enlarged in the past ten years, can give greater service to the Nation than ever in the past. The time has come for more pioneers and leaders in AFCEA and in the industry to gain added conviction from the record of past accomplishments of the men who gave birth to this Association and its journal; to note well how those achievements met the necessities of an uncertain future and to resolve that the even more uncertain future which we face today shall be shaped by wisdom, vision, devotion, and courage to preserve freedom and to insure the peace which comes only to the strong.

Upon the completion of a decade of the publishing of SIGNAL, it is indeed an honor for me, as a representative of the United States Armor Association, to congratulate you on this historical occasion.

Through the pages of your journal, you have welded together a team composed of members of industry and all branches of the Armed Services who are dedicated in the express purpose of keeping this great Nation in the forefront in the fields of communications and electronics. Likewise, you have kept others, interested in national defense, informed of your particular endeavors.

It is well, on this auspicious occasion, for you to look back over the past ten years and view with justifiable pride your accomplishments. Simultaneously, peering into the future will assure us with confidence that the United States will continue to lead the way in communications and electronics which is all-important in keeping this Nation's defenses strong.

William H. Zierdt, Jr. /
Lieutenant Colonel, Armor
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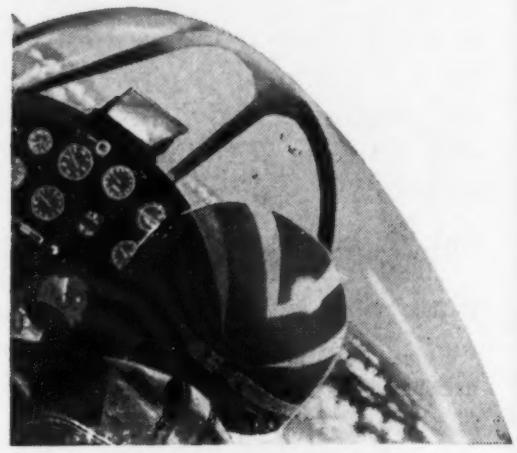

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The Telephone Industry Over the Past 10 Years

by Donald C. Power

I DON'T SUPPOSE A SPOKESMAN FOR ANY PARTICULAR industry was ever found speechless when asked to say a few words about some of the problems with which his industry had been contending. One's immediate reaction is: "Problems? We've had them all." Now while this is not exactly true with any of us, we in the telephone industry do feel that we have had our fair share of them.

One thing I do believe is that each industry has its own peculiar problems, and sometimes we become so engrossed in our job of trying to solve these problems that we forget that others outside the industry may not be fully aware of them. The disadvantage in this is when those others do know our problems, they oftentimes have their own answers to questions and complaints that they might otherwise be directing to us.

Some of these questions which admittedly in themselves might seem very simple and reasonable when left unanswered and unexplained, are, "Why can't I have a telephone (or several) in my new home? Why can't you install a telephone system in our new factory and office building—all by tomorrow morning or next week at the latest?" As you know, practically all of these new homes and new factory and office buildings are going up today in territories which heretofore have been almost innocent of a single telephone pole. Unfortunately, there is no magic that one can use in providing telephone service. It takes a lot of inside and outside plant construction, and it takes many, many man-hours of labor.

Wartime Demands Upon Service

The last ten years has roughly been the period immediately following the end of the Second World War. It has been a period of rapid change in the economy as well as the social habits of the people. During the war period the concern of the telephone industry, like the concern of all industries, was in devoting its full energies to the war and defense efforts which meant furnishing communication services to the Government and Armed Forces of the country both here and abroad. Services to private individuals was merely incidental and residual in nature, and people were willing to accept this situation as a part of the war emergency. However, when the war ended, the picture was changed almost overnight.

People wanted all the things they had been doing without. There was a great accumulation of pent-up "wants". They wanted telephones for their own personal convenience and enjoyment, as well as telephones to conduct all the various businesses that immediately flourished after the war and that were engaged in producing all the other "wants" of the people such as clothing, houses food, automobiles, stoves, refrigerators and a list *ad infinitum* of things, necessaries and/or luxuries.

The war also brought on quite a change in the attitude of the people with respect to the telephone. People had been dispersed all over the country and, of course, outside the country. They found the telephone to be the most desirable means of keeping in touch with the folks back home, as well as an indispensably valuable means of communication in the conduct of business and Government affairs from a standpoint of expediency and immediacy of action. Added to this have been the additional factors of tremendous growth in population, tremendous growth in industrial development, a breakdown of the people into smaller family units, which resulted in a multiplication of individual items required for each family unit, and a general overall speeding up of our way of life—a keeping up with the so-called atomic and automation era.

To pinpoint this tremendous growth and expansion within the telephone industry for you, I might cite as an example a few interesting facts that we in the General Telephone System have experienced in one of our companies, General Telephone Company of California. At the annual meeting of stockholders of that company in April of 1954, the stockholders were told that it was estimated that at the end of 1964, General Telephone Company of California would be serving one million telephones, would have a total plant investment of $300,000,000, and a force of 10,000 people. Subsequently, these

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The Author

In 1951, Mr. Power was elected President of General Telephone Corp., having previously been a director of the company and its Ohio subsidiary, as well as the rate counsel for the General Telephone System. A prominent attorney, Mr. Power has held many public service positions.

forecasts were revised upwards and as recently as twelve months ago it was estimated that the one million station mark might come as early as 1962. When the 1956 operating budget and construction program was prepared late in 1955, the anticipated station demand had been revised upwards again and it was estimated that the company would reach the one million telephone mark during 1960. Early in April of 1956, new forecasts were made, and they show that the one million telephone mark will be reached in the third quarter of 1958.

Program for Expansion

The frequent and successive upward revisions of the estimates of future demand for telephone service has been paralleled by similar changes in forecasts made by most other businesses and research agencies. Early in 1956 the Southern California Research Council released its report entitled "The Next Fifteen Years". The Council's report forecasts that by 1970 the population of the Los Angeles metropolitan area will have reached 8,000,000. The Los Angeles metropolitan area consists of Los Angeles and Orange Counties, and during the past five years the population of the area has increased over one million people. During the past fifteen years the increase amounted to approximately two and one-half million people. The Council's report further states, "Community facilities which seem more than adequate when constructed prove to be inadequate within a few years. Freeways, designed to meet the needs of the future, are barely sufficient to meet the needs of the present. Overcrowded facilities, traffic congestion, school shortages and neighborhood dislocations are only part of the price of rapid, and at times unplanned, growth and industrialization."

In the *Monthly Summary of Business Conditions in Southern California*, published by The Security-First National Bank of Los Angeles for April of 1956, we find some very significant statistics concerning industrial growth in the Los Angeles-Long Beach metropolitan area. Employment in the electrical machinery industry, for example, increased 294% from 1949 to March, 1956, and gains for the same period for the ordnance and accessories industry amounted to 470%, for the instrument industry 175% and for the aircraft industry 208%. During the same period of time, employment in the motor vehicle industry doubled.

Now that we have before us a somewhat general idea of the demand for telephone service with which the industry is faced, the logical inquiry is, of course, concerned with what the industry has done and intends to do about it. At the outset I believe I referred to the attitude of the people toward telephone services during the period of the war and then the radical change in this attitude which we have experienced in these past ten years following the war.

We were thinking primarily of the these people as telephone users, but a little closer scrutiny of our problems shows that we have to concern ourselves with people in many and varied capacities as well as users as they directly and indirectly effect the conduct of the industry's business. By that I mean we have people as employees; we have people as stockholders; we have people as security analysts; we have people as commissioners and other Government agents who are charged with the responsibility of utility regulation; people as subscribers, and then just people who may not today have a telephone or own any stock, but tomorrow—who knows? Anyway, they are people, and, since we in the telephone industry are people too, we look upon all people as our immediate concern. *What they want is our business to find out—how to give it to them* (at a profit, I frankly acknowledge) *is also our business.*

Regarding the industry's relation to people as employees, I believe it has become almost legendary that the telephone company is a good place to work, a good employer. We are proud of this heritage but we do not intend to coast on it. We are trying daily to renew its truth and even improve upon its validity. Following the war, there has been rugged competition in the labor market for personnel.

The telephone industry's needs have been huge, particularly in the way of trained or skilled employees where the supply has been the lightest. Consequently, the industry has been an active participant and believer in on-the-job training and educational programs. These have included training programs set up and conducted by the individual companies themselves as well as training and educational programs conducted by outside universities, colleges, associations, agencies, etc., and participated in by employees of a company at the company's expense. Primarily, these have been programs of training in technical know-how and very closely and directly related to the knowledge and training necessary to do a particular job. Recently, however, there has been a branching out in the fields of education to which industry is finding it profitable to expose their people.

One of the most interesting experiments along this line was that undertaken by the Bell System when it sent a group of its junior management personnel to the University of Pennsylvania for a survey-type course in the study of the humanities. The consensus regarding this experiment seemed to be that those attending felt that it broadened their whole outlook on life in general and towards their jobs in particular, that it was a stimulating, thought-provoking experience from which they emerged better citizens and consequently better telephone employees.

Material Requirements

Following the war, the industry, faced with this unprecedented demand for telephone service, was likewise beset with the problem of shortages in materials and supplies. All the things necessary for the furnishing of telephone service, of course, could not be produced overnight. It required many man-hours of labor to supply the needs of the industry both in the way of materials and supplies from outside sources, as well as the man-hours required to utilize these materials and supplies and convert them into usable telephone systems and services. What has been accomplished here might best be pointed out by quoting a few statistics. At the beginning of the period (1946), there were 32,000,000 telephones. Today this figure has grown to 57,000,000, or an increase of 81%. Gross investment in telephone plants was approximately $7,065,000,000, compared with $18,000,000,000 today, or a gain of 155%.

(*Continued on page* 36)

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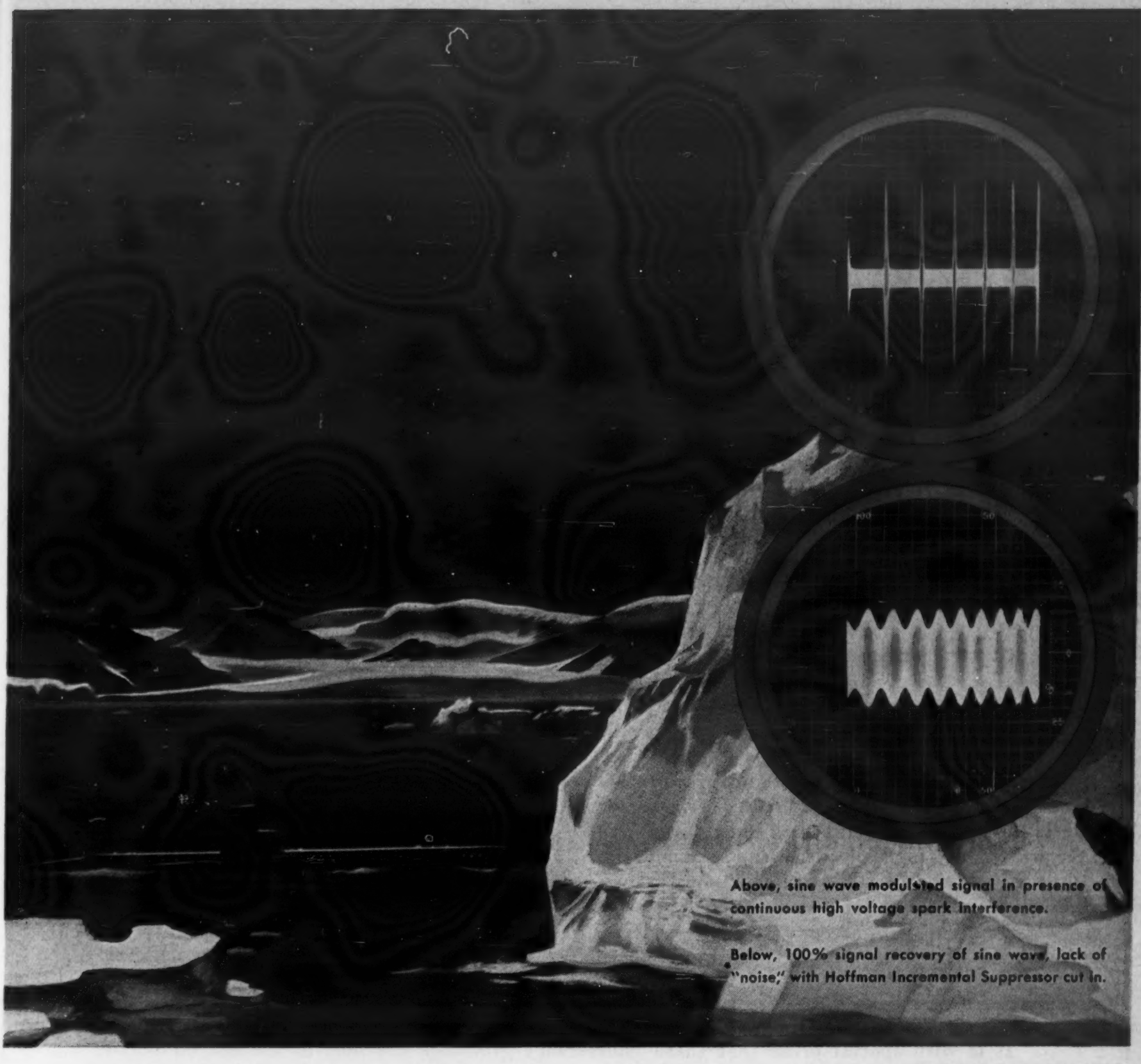

Above, sine wave modulated signal in presence of continuous high voltage spark interference.

Below, 100% signal recovery of sine wave, lack of "noise," with Hoffman Incremental Suppressor cut in.

HOW TO GIVE NOISE THE SILENT TREATMENT

SITUATION: *A submarine surfaced somewhere in iceberg country, attempting to establish communications with distant base.*

PROBLEM: *Interference, or "noise," critically garbles message reception. Radio operator cannot hear message above interference.*

SOLUTION: *Operator switches on Hoffman Incremental Interference Suppressor, an exclusive feature of Hoffman Communications Receivers. Atmospheric noise is silenced—vital message comes through loud and clear.*

This significant achievement in the science of communications has undergone extensive field tests under rugged service conditions. Tests demonstrate that in CW, FSK and AM communications, Hoffman-developed noise limiting techniques can give 100% message recovery from a signal containing atmospheric static 80 decibels greater than the carrier. Interference caused by static, corona discharge, lightning and most man-made noise is reduced to a minimum. Result: clear, reliable radio-communications under extremely adverse operating conditions. The imaginative engineering teamwork and skill that pioneered in the reduction of noise in radio communications is ready to tackle your communications problems too—from basic research through final production.

Hoffman Laboratories is engaged in these many other associated fields of electronics:

Airborne Radar and Navigational Equipment ... Missile Guidance and Control Systems... Electronic Countermeasures...Advanced Communications Techniques in the VLF, HF, VHF and UHF regions...High Speed Search and Electronically Tuned Receivers.

This creates a constant need for engineers and physicists of highest calibre. Professional stature in mechanical engineering, electrical or electronics engineering or physics is required.

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A subsidiary of Hoffman Electronics Corporation
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It is axiomatic that to expand plant and services to such an extent requires a vast amount of capital. Following the war, telephone people recognized the demand for service and the consequent expansion and construction programs that had to be undertaken. We went to the money market to secure such capital and found that we had to compete not only with all others in our own industry but with all others in all industries who were there, just as we were, for a share in the money market for their respective expansion and growth requirements. To get the capital we needed we had to be able to show the potential investor that we could and would earn a good return on his investment, also satisfying him with respect to its security features as an investment, as well as its opportunities and expectations as to future accretional growth value.

Increased Rates Needed

To establish and show a good earnings record, we, as a publicly regulated utility, had to go to the various state commissions or other designated Government agency to apply for and see that we were granted an increase in our rates for services. This process in itself involved many problems. It involved the changing of many firmly held concepts with respect to rate-making and its regulation. Rates had to be kept current with the rapidly changing value of the dollar in the expanded economy that developed following the war. Ideas about long and drawn-out, time-consuming methods of procedure in rate-making had to be changed. Ideas about what constituted a fair rate of return, ideas about cost of money, depreciation, etc., also had to be changed if we were to realistically and practically face the issues that were before us for solution in this changed economy. All these things have been the pressing and immediate concern of the industry.

As progress was made in this area and good earnings began to emerge, our next problem was how best to let the investing public know about the worth of its securities as an investment. To do this, we have tried to establish and maintain a close relationship with the security analyst, upon whose advice and recommendation much money flows into and out of particular companies and industries, by furnishing them with all pertinent financial and statistical data as it becomes available, as well as with any and all other information that directly or indirectly will effect our business. As a further means of alerting the public's attention to the industry as a good investment potential, we have engaged in large scale advertising programs both on a national as well as a local basis.

Improvement of Telephone Service

Last, but surely not least, let's take the subscribers. Following the war, and, in fact, up until a relatively recent period of time, we have been almost frantically engaged in trying to build and expand telephone plants to furnish to the subscriber more telephones and more telephone system installations. There has been a primary concern and emphasis on quantity. Recently we have been trying to better this ambition. We are trying to improve and change the type of telephone service that is available, both from a technical as well as from an aesthetic point of view. We have set up special merchandising departments whose business it is to find out what our subscribers want and how we can provide it for them. Lightning-like efficiency, combined with eye-appeal in material form and courtesy in service, have become our new ambitions.

As we briefly view the direction of our efforts over the past ten years we find that we have set our feet in certain directions. In that very path we find, today, tomorrow's problems—namely, how to hold on to what is good that we have accomplished, how to let go of what becomes obsolete, and how best to tend to today's knitting while at the same time we are dreaming and planning for our work of tomorrows. You may be assured that it is toward this goal that we shall direct our energies.

It is with special pride that these anniversary greetings are sent to the Armed Forces Communications and Electronics Association on its 10th anniversary. The achievements of the Association during the past decade have proved again the wisdom of the founders of the organization and bespeak a continuing important role for years to come.

In the formative days of the Association, it was my good fortune to work closely with the late beloved Brig. Gen. Stephen H. Sherrill who was the first executive secretary and editor of SIGNALS. He was anxious, as were those with whom he was associated, notably Maj. Gen. Harry Ingles, then Chief Signal Officer of the Army, and Brig. Gen David Sarnoff, chairman of the board of the Radio Corporation of America, to utilize the experience and form of the Ordnance Association as developed over many years. Due to his industry, affability, and loyalty, the new Association began under the best of auspices and upon a firm foundation. His successors in office, led by the talented and lamented late Col. George P. Dixon, have carried forward his ideals with excellent results.

We of the A. O. A. take this opportunity to pledge anew to the officers and members of the AFCEA our co-operation and support. The demands of the national defense of the United States will continue to require the united efforts of industry, science, and the military. May your Association carry on its good work with increasing success.

Leo. A Codd / **Executive Vice President**
American Ordnance Association

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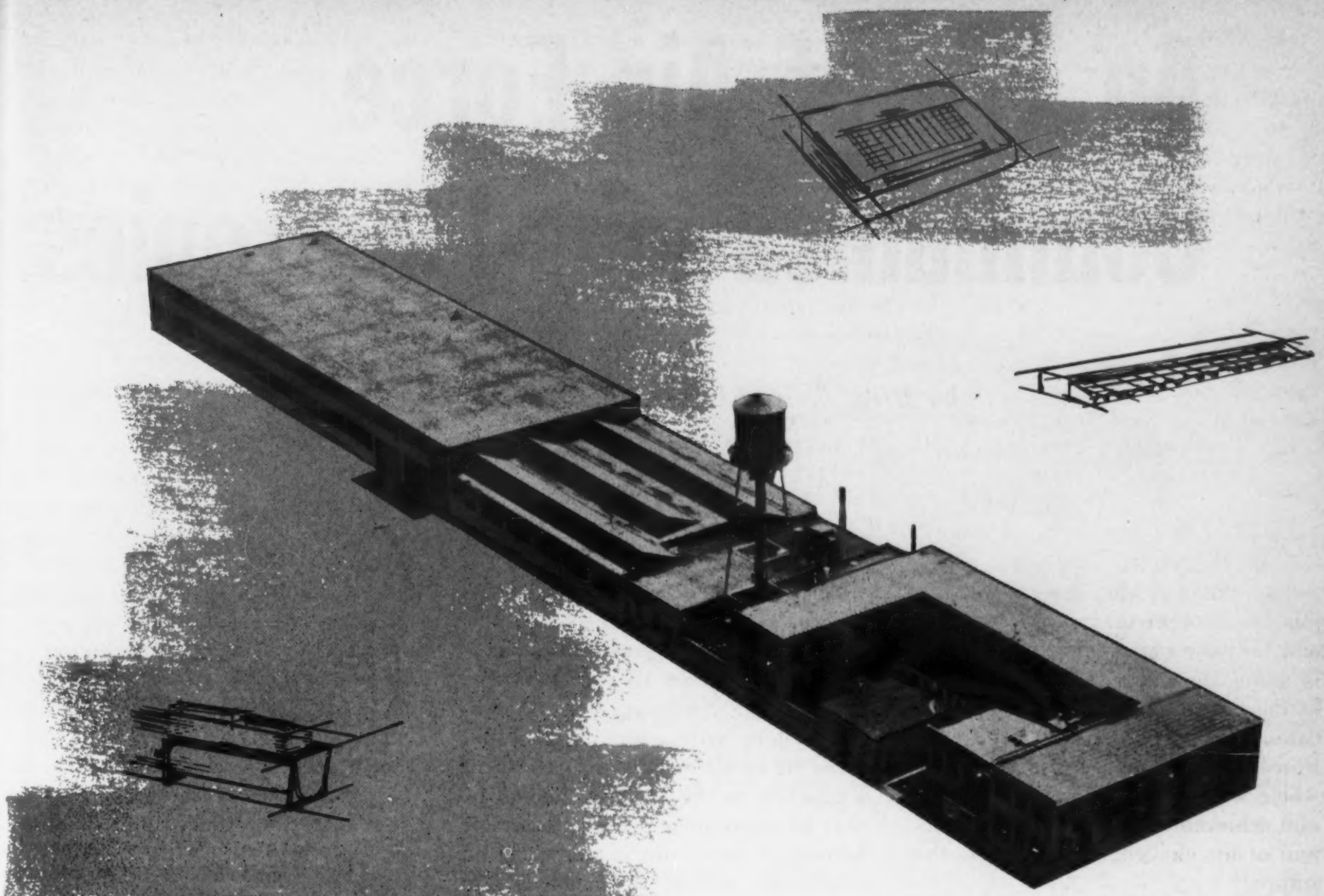
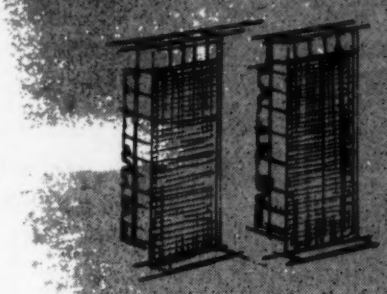
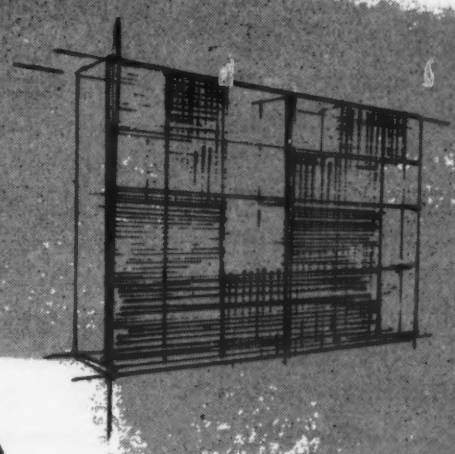


LEICH for dependable communication equipment





For almost 50 years independent telephone companies have looked to Leich for dependable communication equipment.

From Leich's modern plant have come many developments in Telephony which have furthered the progress of the industry.

In critical times Leich has been an important supplier to the Armed Forces.

Complete facilities for the design and manufacture of sensitive electrical components plus an oft-proved record for expert workmanship and on-time deliveries make the Leich organization a valuable member of our country's communication system.

LEICH manufacturers of telephones, switchboards, and related apparatus since 1907
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An Era of Air Force Communications-Electronics

by Brig. Gen. Alvin L. Pachynski, USAF

THE YEAR 1956, WHICH MARKS the tenth anniversary of industry and military partnership in AFCEA, is additionally a significant milepost in the road of progress in communications-electronics within the Air Force. It represents a point in time where we can take stock of our needs and achievements in the last ten years and of the challenge facing us in the future.

This era can best be described as an era of change; changes in the character of war brought out by scientific break-through and constantly accelerating technological advances which have resulted in the concept of nuclear warfare. Such a concept provides for the maintenance of a highly mobile strategic retaliatory force, maintenance of a world-wide structure of air bases, air defense of the continental United States, tactical operations in coordination with the Army, and airlift of personnel and materiel.

Progress in Refinements

To meet the requirements of this strategic concept, the U. S. Air Force determined that the most austere minimum requirement was 137 combat wings, each wing containing its own integral communications-electronics capability. This, however, is only a small part of the communications-electronics requirement for support of Air Force world-wide operations. The communications-electronics means required to control these wings, including air surveillance and identification, and air traffic control and navigation, are another part of this story.

All areas of communications-electronics required refinements, new developments, new systems, and new standards to meet the needs of the nuclear age. No longer was a bombing system satisfactory that would allow us to hit a city; we had to hit a building in the city; we had to be able to communicate with a strategic bomber at any point in the world on a moment's notice. A brief look into the various areas will serve to illustrate the drastic evolutions of Air Force communications-electronics during the past decade. For purposes of discussion, these areas have been identified as: Combat Electronics, Air Defense, Air Navigation Aids, Air/Ground Communications, and Ground Communications.

Combat Electronics

Combat Electronics includes those devices integral to the fighter, bomber, transport, or missile. Some of our greatest strides have been in this area.

For example, World War II fighter aircraft were equipped with a gunsight that left much to the discretion of the pilot. During the latter stages of that war, some models of the radar gunsight came into limited use, yet they, too, left considerable room for human error. Consider that modern jet combat aircraft, closing on each other from 10 miles apart, would leave the pilot less than 30 seconds to identify, track, aim, and act before the planes meet. Such conditions permit no human error, nor do they allow time for the consummation of the required actions. The only solution to this problem is automation to the greatest possible degree. During the Korean conflict, our radar gunsight made possible the high kill rate of our fighter aircraft. Even this sight is no longer adequate. Our F-102 interceptor is equipped with fire control computers and radar which acquire the target, guide the aircraft to the target, and release the rockets at the most opportune time.

Precision Bombing Aids

Our need for bombing accuracy is continually increasing, yet jet bombers operate at such speeds and altitudes that conventional bomb sights are not adequate. Neither are the World War II radar bombing systems suited to such operations. In recognition of this problem, the Air Force, shortly after World War II, gave high priority to development of a precision bombing system. One of the early developments was the AN/APQ-24 developed by the Air Force and used in our early jet bombers such as the B-45. Later, the present K bombing systems were developed, which incorporated a greater degree of automation and reduced the element of human error. Needless to say, we are developing newer systems with computers which all but eliminate human error.

The operating ranges of modern

The Author

General Pachynski, a national vice-president of AFCEA, is the Director of Communications-Electronics of the U.S. Air Force.

Air Force ROTC Cadets inspect a huge early warning radar screen, at Keesler Air Force Base, Biloxi, Miss., one of the installations which forms an important part of our air defense network.

As the radar site (AN/FPS-3) sends forth its probing beams in a never-ending pattern of vigilance, a North American F-86D "Sabre" jet roars off on an intercept mission.

military aircraft have developed to such a point that no nation is secure from air attack. Air defense then is the means of discouraging and preventing an enemy from attacking the United States and our overseas installations.

Air Defense—SAGE

Communications-electronics plays a vital role in air defense. It is the means of detecting, identifying, and tracking hostile aircraft as well as guiding our interceptors in to make the kill. As in the case of combat electronics, we must attain the highest possible degree of automation in order to cope with the speed of modern bomber aircraft. The SAGE system will achieve a high order of automation, thus reducing the time element and the possibility of human error. This system incorporates centralized control of intercept operations and has the means of visually displaying the air situation to the combat commander. It can track a large number of hostile aircraft and intercepting fighters. The SAGE system was made possible by the development of a high-speed electronic computer and a ground/air data link. Also contributing to the system are improved search and height-finding radars, the extensive commercial telephone system, and transmission of radar data.

Air Defense—TACAN

A complex fixed system such as SAGE does not lend itself to mobility and therefore cannot be used in field operations. Yet, air defense is a vital part of, and inseparable from, tactical operations. Here we utilize mobile radars which are similar to the fixed sets of the continental system. Our tactical control groups are highly mobile and capable of deploying with the ground situation. A large share of credit for our successful air operations in Korea must be given to the tactical control groups for their employment of comprehensive radar systems, communications data links, and electronic display of the air situation.

Jet speeds, and the greatly expanded volume of military commercial and private aircraft in the past ten years, demanded a new and better system of navigation and traffic control. A major contribution by the military in filling this need is TACAN. This equipment — which provides pilots with continuous information on distance to ground stations as well as direction— is a vast improvement over former navigation systems which provided direction only. Operationally this new capability permits such things as: straight-in approaches in place of complex and time-consuming approach procedures; holding patterns at any location within range of the ground station instead of only over radio stations or intersections, and multiple airway routes between two stations rather than only one. TACAN also provides for greater accuracy than former systems. In azimuth, it is accurate to plus or minus one degree, and in distance it is accurate to two-tenths of a mile.

By July of 1957, the U. S. Air Force will have sufficient ground stations to provide satisfactory terminal facilities for our new bomber and century series fighters in the U. S. and key overseas locations. As the system is expanded in future years all USAF operational aircraft will depend upon TACAN.

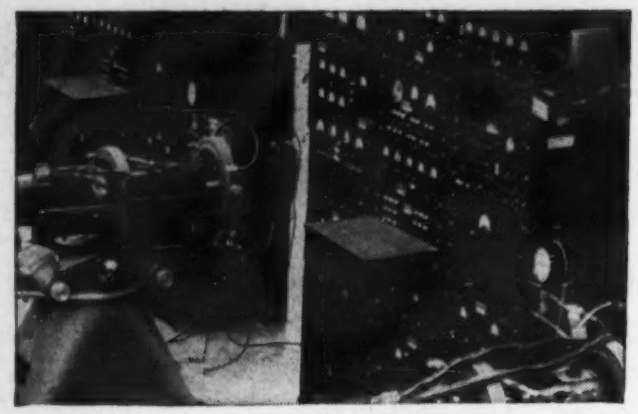
Navigation Systems

In long-range, base-reference navigation, LORAN came into the picture just in time to assist in air operations against Japan and is still used extensively today. The replacement for LORAN will have a range of 2,000 miles or better, over land or water, day or night. The USAF has developed NAVARHO as a long-range, base-

(*Continued on page* 42)

for fast engineering, development and production

a separate Sperry division devoted to



Production test consoles

Out of its many years of pioneering and managing major electronics systems, Sperry is keenly aware of the critical role that sub-systems and support equipment play in the *testing, evaluation* and *performance monitoring* of modern weapons systems.

Now—with emphasis upon faster and more extensive service to the customer — Sperry has organized its broad activity in this area into a streamlined team of specialists. It is the Microwave Electronics Division.

This team is a large and experienced one, resourceful engineers with inventive, systems knowledge supported by skilled technicians and craftsmen to convert ideas quickly into pilot models or quantities of hardware. Development, environmental and materials laboratories plus standards specialists combine their tools and talents to assure that items ranging from components to consoles will perform with certainty in operational use.

In addition to its widely-known Microline* test equipment, the new division is expanding its contributions to the military and industry with advanced weapon support systems, antennas and a broad line of precision components.

Emphasis is being placed too upon new instrumentation and standards for advanced research laboratories, special radar systems, target simulators, computers and evaluators for radar, electronic, missile and inertial guidance systems.

A proven key to the division's ability to solve new developmental problems rapidly is the efficient combination of engineering and development laboratories and shops. Each engineering group is supported by a development laboratory staffed with experienced technicians. Engineers work closely with machinists and assemblers to deliver pilot models on minimum schedules.

For quantity production, a complete manufacturing unit has specialized facilities to supply microwave products ranging from

UMI

Weapon system support equipment

microwave electronics

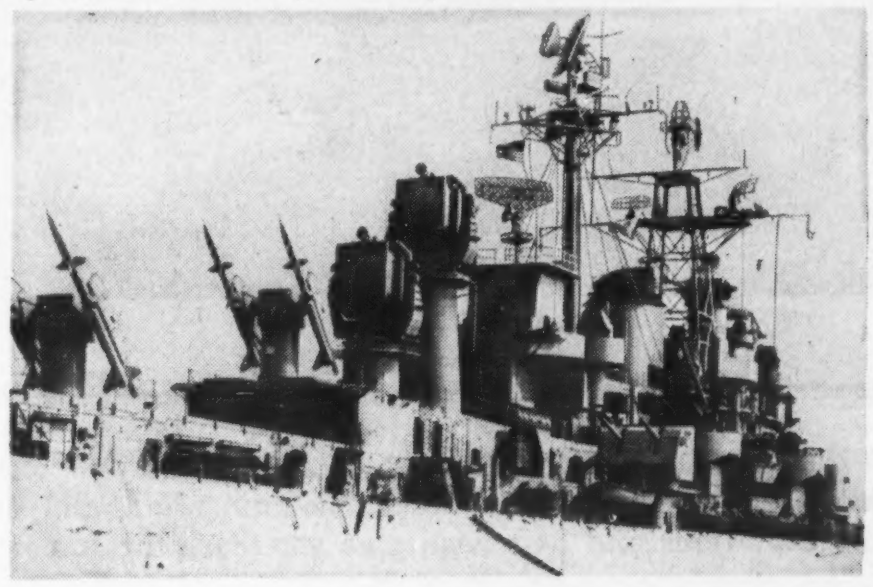
complex waveguide assemblies to complete racks of electronic equipment.

Military agencies or industrial companies concerned with any phase of electronic systems and sub-systems or the testing of such equipment can profit from employing these Sperry capabilities especially organized to speed up important projects and assure their success.

Write us for information about equipment now available or for proposals on new developments.

*T.M. Reg. U. S. Pat. Off.

Special antennas and system components



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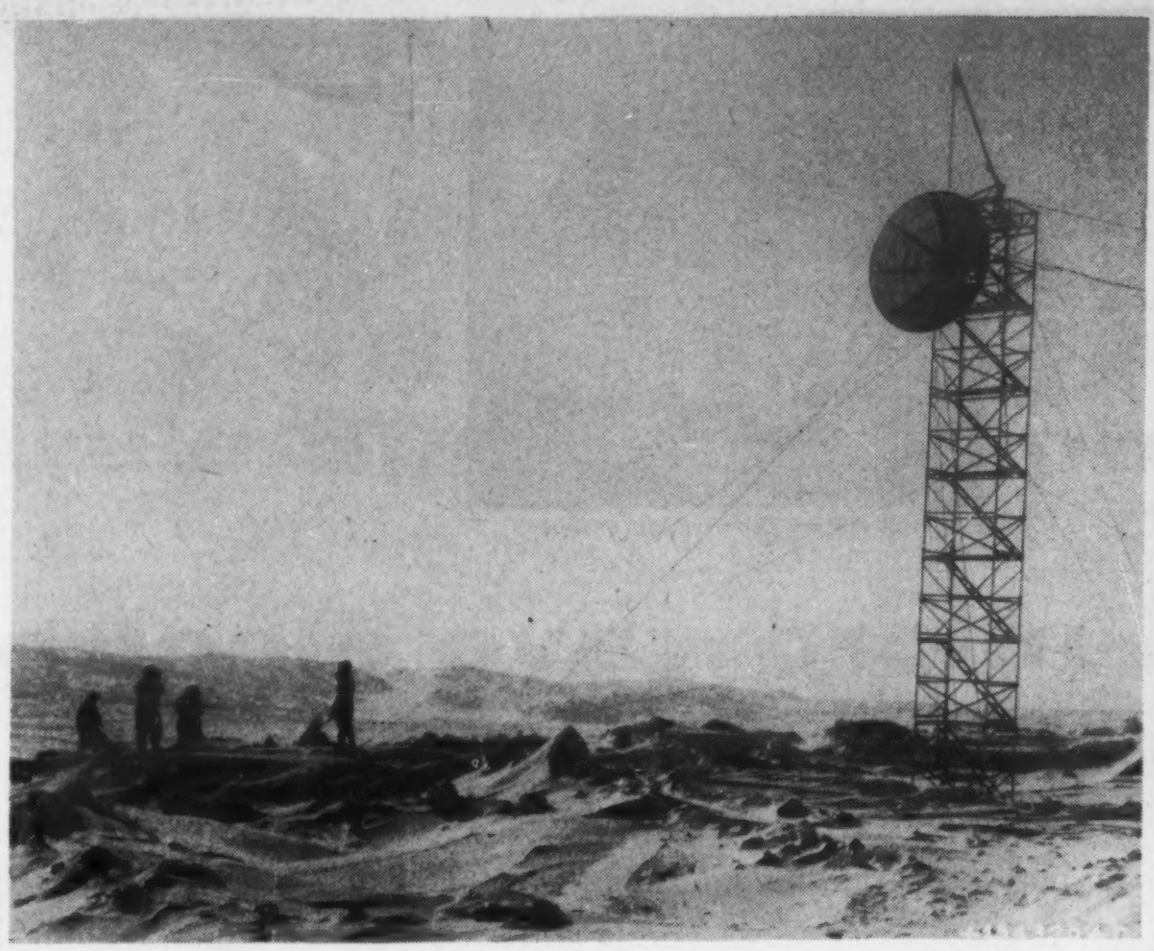
reference navigation system which gives us a range of 2,500 miles accurate to 1% in distance and ½ degree in azimuth. This data is provided automatically to the pilot and displayed on a meter.

Self-contained navigational aids (computers, dopplers, inertial systems, etc.) are also significant developments since they free the aircraft from dependency on a ground environment. This, plus the fact that they can better cope with jamming and other forms of interference make them particularly attractive for military use. Computers and doppler systems are already in widespread use in the Air Force.

Landing aids have seen many significant improvements. GCA, introduced during the war and proved during the Berlin airlift (AACS units handled more than 70,000 GCA landings during this around-the-clock operation) is now automatic. Combined systems, GCA and ILS, can handle up to six aircraft simultaneously during final approach. Important, too, in this jet age, are new developments such as VOLSCAN, by which aircraft



Above: The antenna for experimental radar stands on a wind-swept hill in the Gulf of Boothia area of northern Canada where a Distant Early Warning (DEW) Line site is being built. Several dozen sites are are being built above the Arctic Circle to complete the 3,000 mile DEW Line.

Below: An isolated Distant Early Warning (DEW) line site in the Gulf of Boothia area of northern Canada. This is an auxiliary site, second largest of the three types of sites being built by the U. S. Air Force from Baffin Island to Alaska.

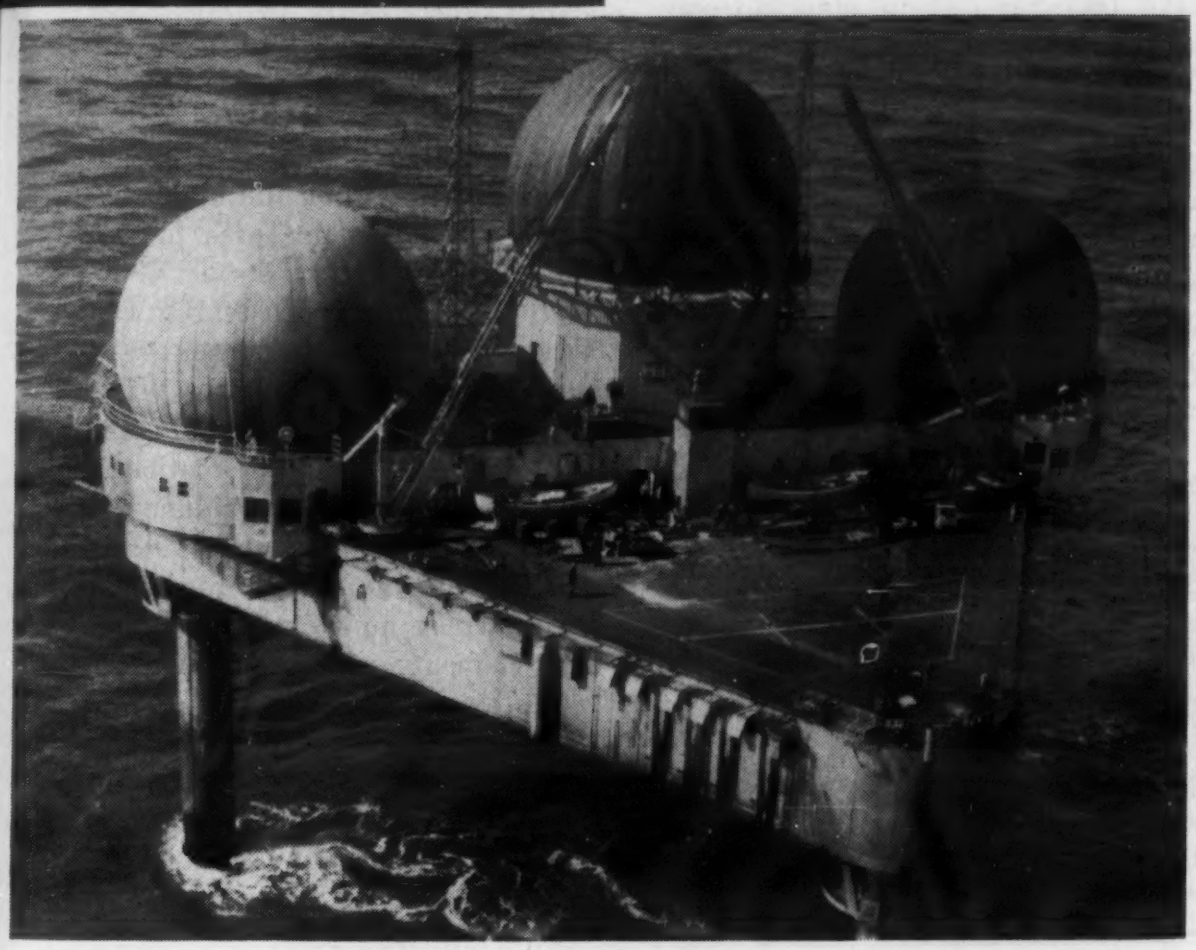
We in the National Defense Transportation Association join with your many other friends in offering all of you in the Armed Forces Communications and Electronics Association our heartiest congratulations and best wishes as you mark this important occasion of your 10th anniversary.

It should be a great satisfaction to all of you in AFCEA to have achieved such a distinguished record of outstanding service and dedication to the American soldier and to the Nation, in both war and peace, a record which is continuing to add new accomplishments as America now enters the complex atomic-warfare age.

Congratulations to all the members of AFCEA on a job well done!

Clark Hungerford / **National President**
National Defense Transportation Association

Left: Watching a radar scope inside the Texas Tower, 110 miles off Cape Cod. Under command of the 762nd Aircraft Control and Warning Squadron, based at North Truro, Mass., the Tower Unit maintains a 24-hour alert over the surrounding Atlantic in search for all approaching aircraft. In the plotting room, airmen identify the aircraft and stand ready to give advance warning to the mainland when danger threatens.



Pictured at the left is an aerial view of the U. S. Air Force's first off-shore radar station on George's Bank, 110 miles east of Cape Cod, Mass. The three plastic and fabric covered domes house radar antennas. Below main deck is the supply and utilities deck and the crew's quarters. Top-side, are the operations and plotting rooms where crews watch for early warning of aircraft approaching from the sea. White lines on platform mark landing area for helicopter which flies in supplies and rotates tower personnel.

can be led into an instrument-approach gateway for landing at the rate of two per minute per instrument runway.

Short-range air/ground communications have advanced from a four-channel VHF set to UHF equipment with a capacity of 1750 channels, twenty of which may be pre-set. This move has taken us out of the crowded VHF area of the spectrum. The additional channels provide the flexibility required in aircraft subject to movement throughout the world. The next job is to provide for greater communication speeds. Voice communications cannot meet the requirements imposed today by aircraft speeds and traffic density on air routes and in terminal areas. Development and refinement of the airborne data link is being pushed to meet this challenge. This is one of the devices which will eventually make our air defense and air traffic control almost automatic.

Long-range air/ground communications still rely on high frequency techniques. But the airborne equip-

Congratulations to the Armed Forces Communications and Electronics Association on completing the 10th anniversary of its service to the American soldier and to the Nation.

All those connected with it can rightfully be proud of its distinguished record of accomplishment in war and peace. I have particular admiration for the manner in which AFCEA is carrying on today in that splendid tradition, and facing up to the new and complex problems of atomic-age warfare.

On behalf of The Quartermaster Association, I extend to all members of AFCEA our very best wishes.

H. Feldman /
Major General, USA (Ret.)
Executive Vice President
The Quartermaster Association

ment of today, in which the pilot automatically selects a voice channel, is a far cry from the radio operator's laborious tuning of a CW channel on a B-17. The present double side band system for a single communication channel conserves excessive spectrum space and is expected to give way to the single side band technique.

Global Communications

The channel capacity and efficiency of airborne equipment has been amazingly increased. Even more striking has been the reduction in size and weight of components. This must go even farther; a saving of one pound in airborne equipment can save ten pounds in gross aircraft weight. This saving is then convertible to greater aircraft range, speed, and performance.

In carrying out its world-wide mission, the Air Force needs global communications. In 1947, our facilities were patterned to meet the requirements of fighting two separate wars under theater commanders. The concept of a strategic air war centrally directed had just been recognized.

To support this concept, a system of key communications stations operating along a beltline of multiple radio circuits around the northern hemisphere was conceived. Each such station also was provided with a number of air/ground channels. The over-all system was designated the USAF Global Communications System (GLOBECOM).

The implementation of GLOBECOM has been influenced by changes in the deployment of the Air Force and by the progressive change in the structure and operation of the Air Force. Message volume soon required numbers of channels. Single-channel radioteletype gave way to four-channel multiple circuits. A part of these have been replaced by six-channel side band circuits. New multiplexing equipment, providing sixteen teletype and three voice channels, is now being installed. Today we have a common user system in being. Any base can send a message to any other base. The basic concepts of GLOBECOM planners have proven sound. The elements requiring continuing attention are speed and reliability.

In order to increase speed in point-to-point communications, we have replaced certain manual relay centers with semi-automatic centers. A prototype automatic switching center is in operation. Even so, some speed requirements cannot be met by a common-user system, and we have allocated direct circuits in these cases. Within the system, we also furnish a patching service to put users in direct communication where required.

FPIS Pioneered

The USAF pioneered, for purposes of greater reliability, the use of Forward Propagation by Ionospheric Scatter (FPIS) and Forward Propagation by Tropospheric Scatter (FPTS) for communication for formerly isolated areas. Higher speed teletype is in limited use. Voice, telephoto, facsimile, and data transceiver services are provided within the system today.

Communication from a commander to his aircraft thousands of miles away is possible through use of long-haul circuits patched into air/ground channels. A more accurate name, "The USAF Strategic Communications System (STRATCOM)" has now replaced the familiar GLOBECOM.

Solving our long-haul communications problems has not been easy. When minutes count in intercepting an invader, diverting a nuclear bomber, or effecting the rendezvous of a tanker with thirsty aircraft, any delays can be disastrous. Nevertheless, today we are endeavoring to keep pace with the more exacting operational needs of the Air Force.

Emphasis on Automaticity

This, then, is the story of communications-electronics in the Air Force during the last ten years. We have achieved a great deal. As of today, we are but scratching the surface in respect to providing the kind of support required in this area to permit the full exploitation of air weapons and guided missiles capabilities entering the Air Force inventory now and in the foreseeable future. To fulfill this requirement requires continuing emphasis on automaticity of means for warning, guidance, and control, and on complete reliability of the communications required for this purpose and for command of all the elements of air power. These goals contribute a continuing challenge which can be met only through the kind of progress already achieved as the result of industry teamwork.

On the 10th anniversary of the Armed Forces Communications and Electronics Association, the Association of the United States Army offers both congratulations and appreciation.

We congratulate you for your courage and foresight in founding your Association at a time when too many Americans were urging demobilization and de-emphasis on national defense, and we offer our appreciation for the services you have performed for the Army, and the other Armed Services, and the Nation.

I know I am speaking for the entire membership of the Association of the United States Army when I extend to AFCEA and all its members the hope that your Association will continue to serve our country for many more anniversaries.

Walter L. Weible / **Lieutenant General, USA**
President
Association of the United States Army

project Vanguard

The first of two articles on the earth satellite program.

A Progress Report

by Dr. John P. Hagen and Charles DeVore

On July 29, 1955, the White House announced that the President had approved plans for the launching of small, unmanned, earth-circling satellites as part of the United States participation in the International Geophysical Year (IGY), (Signal, November-December, 1955).

This country's participation in the IGY, an 18-month period between July, 1957, and December, 1958, is sponsored by the U.S. National Committee for the IGY, established by the National Academy of Sciences, and by the National Science Foundation.

Project Formed

For technical help in the earth-satellite program, these agencies naturally turned to the Department of Defense, which was already engaged in other phases of the U.S. scientific program for the IGY, and had a ten-year record of successful exploration of the upper atmosphere with rockets. Here, the program became known as Project Vanguard, and management of the three-service project was assigned to the Chief of Naval Research. The Naval Research Laboratory, in turn, was assigned the responsibility for implementing the technical program, including the production, launching, and radio tracking of the earth satellite.

Although Project Vanguard is only a part of a comprehensive scientific assault which embraces the oceans, and the Antarctic, as well as the sky, it is the most dramatic part of that program, and a scientific experiment without precedent. Accordingly, its success will require the cooperation of scientists both in and out of the Government, and of American industry, who will be depended on for the development, where necessary, and the manufacture of the multitude of components, both miniature and gigantic which will be needed for the task.

Headquarters at NRL

Headquarters for Project Vanguard, however, are at the Naval Research Laboratory, and it is, therefore, the obvious place to go for a progress report. There, civilian scientists are busy working on, and co-ordinating the work of others, not only on the satellite-launching vehicles, but also on experiments to be done with the satellites, and on the instruments with which to do them. The decision as to which experiments will be performed with the first satellite will be made by a special technical panel of the U.S. National Committee for the IGY. At the time this article was written that decision had not been announced, but was expected to be made in the near future. Some possible scientific uses of an instrumented, as well as an uninstrumented, satellite were pointed out in the article in Signal referred to above.

Three-fold Mission

Project Vangard has a three-fold mission: (1) to place an object in an orbit around the earth; (2) to determine that orbit, and (3) to obtain useful scientific information from that object.

The first part of this mission is to be achieved through the development and use of a satellite-launching vehicle incorporating sufficient propulsive energy and the necessary flight path control to establish a satellite

Author

Dr. John P. Hagen, as Project Director for Vanguard, is responsible for the direction and coordination of this project within the Naval Research Laboratory. Dr. Hagen joined the Laboratory in 1935, serving as head of the R-F Research Section until 1954, when he was named as the first superintendent of the Atmosphere and Astrophysics Division, a position he will resume at the end of his work on Vanguard.

Author

An Associate Editor and a frequent contributor to Signal, Charles DeVore has been assistant technical information officer at the Naval Research Laboratory since 1950. Before he joined the laboratory staff, Mr. DeVore was first a technical editor for the Army Signal Corps and later, chief of the Requirements and Standards Division of the Signal Corps Publications Agency, Fort Monmouth, New Jersey.

COLLINS RECEIVER / TRANSMITTER LEADS THE *TACAN* PROGRAM

Superior accuracy and reliability characterize the rugged ARN-21 (XN-10) developed by Collins for the Navy Bureau of Aeronautics. The accuracy of this TACAN unit is above that of test equipment normally used for military electronics. Precise information is assured by greatly advanced bearing and distance circuits. Pressurized for very high altitude, the Receiver/Transmitter features improved cooling and modular construction for ease of maintenance and packaging flexibility. Collins ARM-22 TACAN test set, also developed for the Navy, is of the high order of accuracy the TACAN equipment demands.

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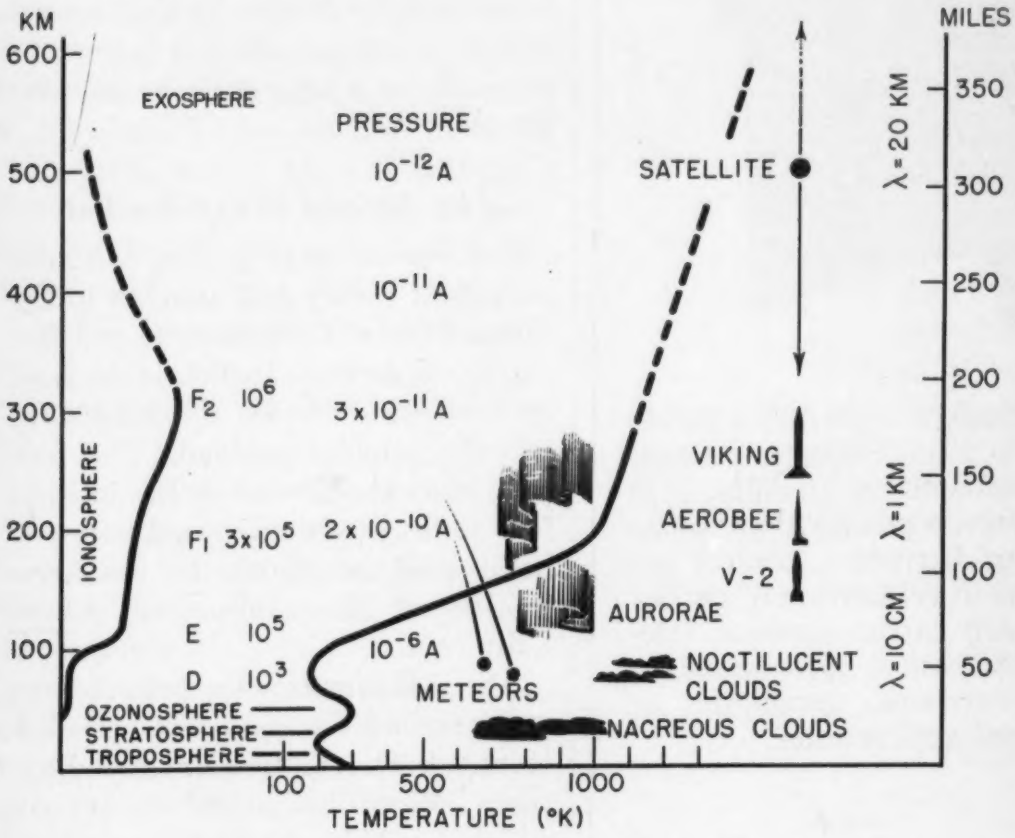
in an orbit some 200 to 300 miles above the earth. The second part is to be achieved by tracking the object, using optical and radio instruments. The third part can be achieved in two ways: first, by observation of the satellite from the earth, and second, by telemetering information from instruments contained in the satellite.

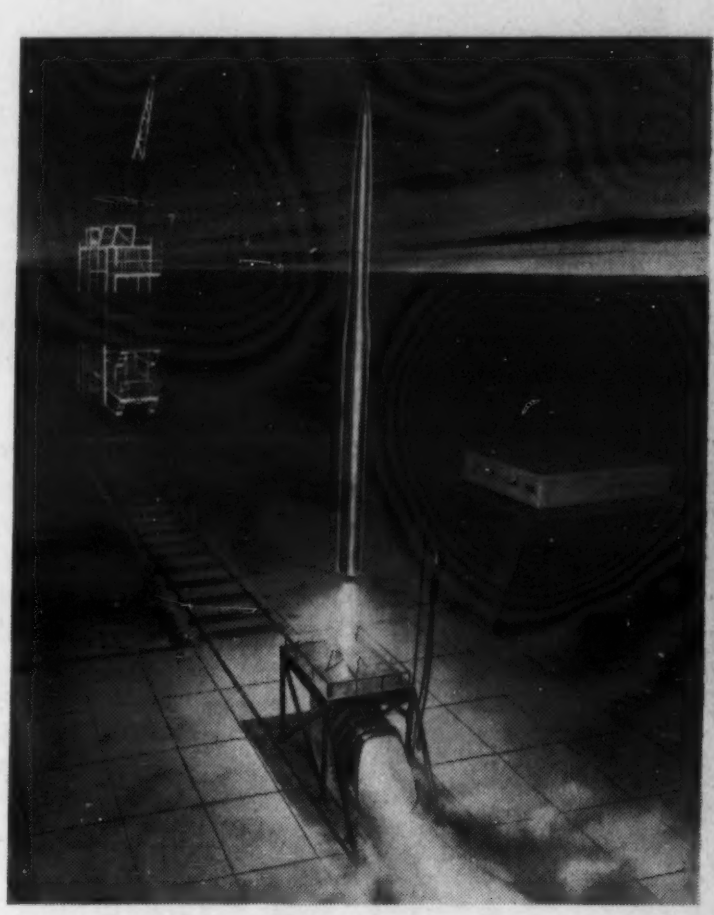
The short time-scale allotted to the performance of this mission (the earth satellite is to be launched within the next 2½ years, rather than five to ten years from now) makes it necessary to use existing techniques and components, wherever possible, rather than to take time to develop, manufacture, and test possibly more efficient devices. And the importance of this mission, from the standpoint of scientific value, stresses the unusual demands for high levels of performance and reliability that will be required for all Vanguard components and systems.

Although the men associated with the project are confident of ultimate success, because of their experience over the past ten years with rocket research, they are well aware, too, of the headaches and tremendous effort which will be involved in achieving a successful mission.

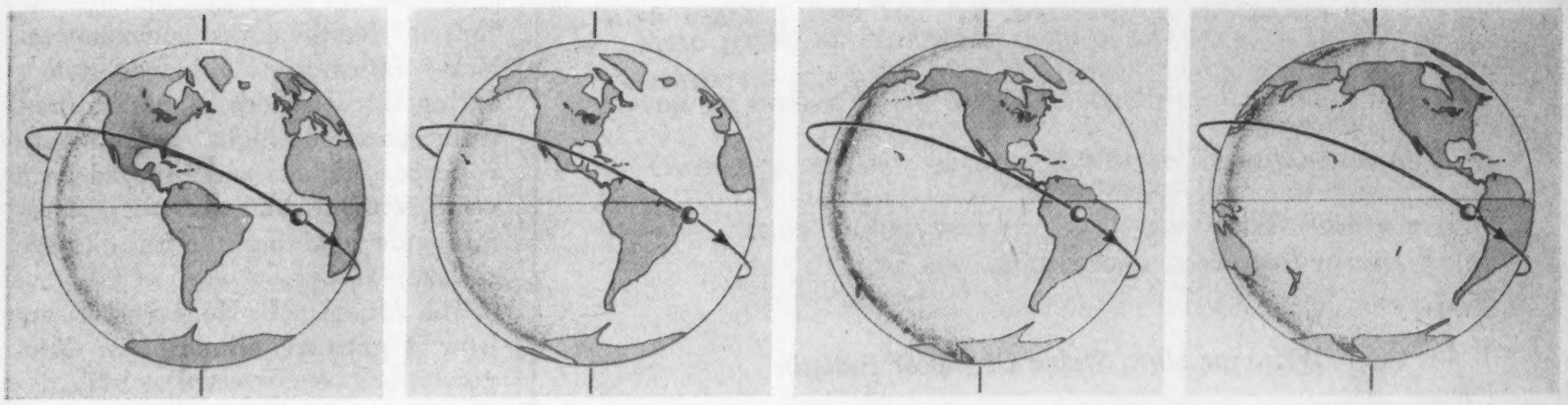
Milton W. Rosen, technical director at NRL for Project Vanguard, recently outlined some of the problems connected with the first part of that mission, that of placing a satellite in an orbit. At the present stage of rocket development, and with existing chemical fuels, it will not be possible to do this with a single-stage rocket. After a careful consideration of possible two- and three-stage rocket combinations, a three-stage launching vehicle design was selected, in which the first two stages will be guided and the third stage maintained in a fixed position, or orientation, while it is firing. Mr. Rosen points out that this design represents the smallest



A man-made satellite, circling the earth at an altitude of approximately 300 miles can add to man's stockpile of knowledge of the atmosphere and benefit long-range radio communication. Solid lines on this chart indicate present scientific data obtained through research with upper-atmosphere rockets; dashed lines, scientists' estimates, to be confirmed or refuted by instruments in the satellite.

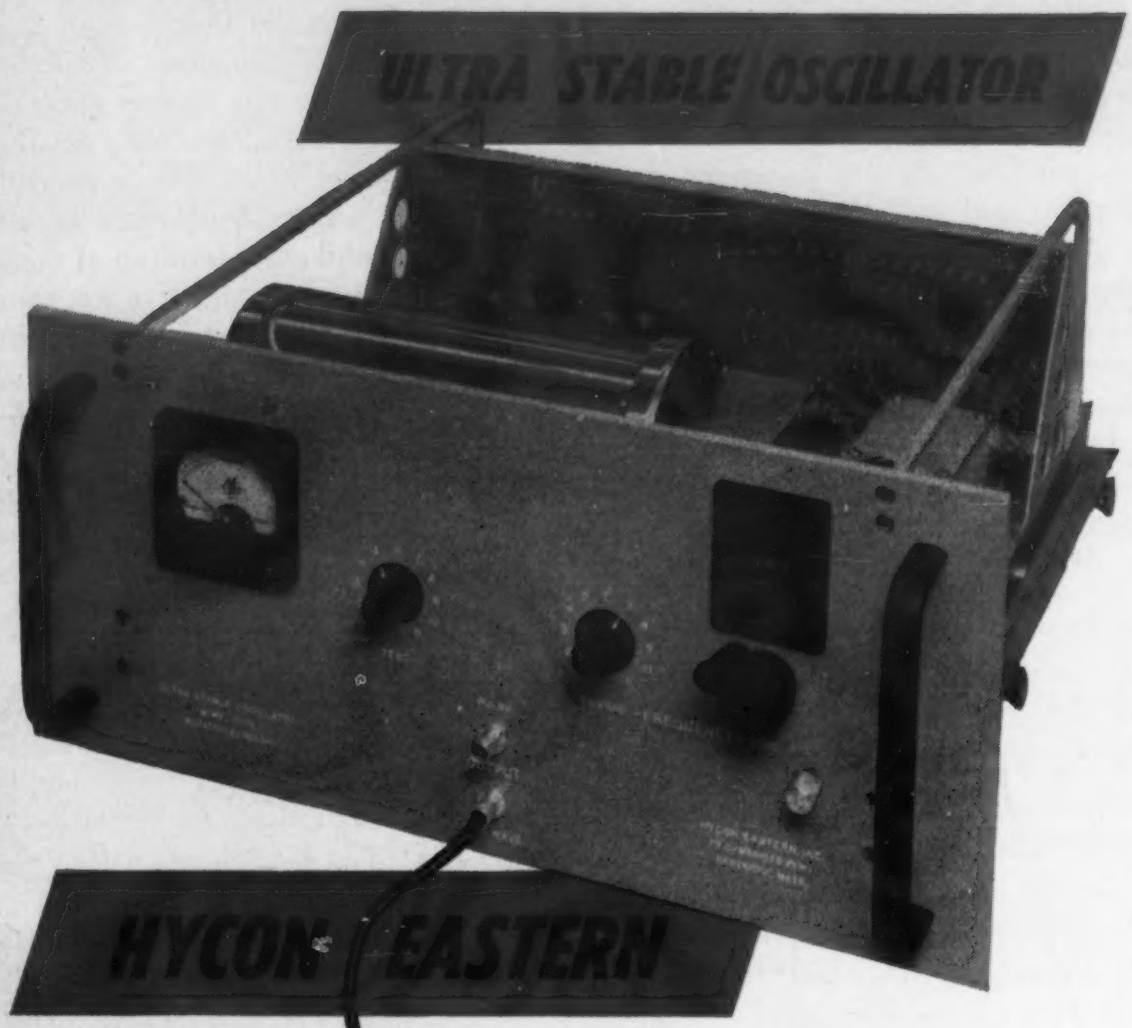


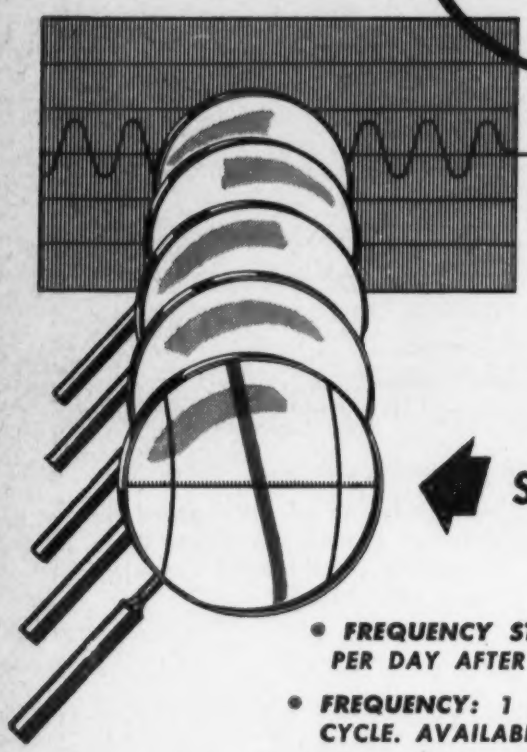
Artist's conception of the take-off of a Vanguard three-stage launching vehicle at Patrick Air Force Base in Florida sometime during the International Geophysical Year, 1957-1958.



Satellite launching will be made from the east coast of Florida, with an orbit inclined approximately 40 degrees from the equator. The satellite is expected to travel around the earth once every 90 minutes; in that time, the earth will have revolved beneath it, so that after one revolution the satellite will appear about 25 degrees west of its launching site, after two revolutions, about 50 degrees, and so on. The satellite's orbit is expected to cover a band in the temperature latitudes between about 40 degrees north and 40 degrees south of the equator. This will permit a majority of scientists participating in the IGY to observe the satellite and will also provide the satellite with a broad expanse of the upper atmosphere in which to make scientific measurements.

Precision Frequency Source...





Hycon Eastern's new Ultra Stable Oscillator is a one megacycle signal source of exceptional stability. It is useful wherever precise time measurements or frequency control are required, as in reinsertion of carrier in suppressed carrier systems, telemetry, astronomical measurements, navigation systems, geophysics or other critical applications.

STABILITY: 1 PART IN 10^9

- *FREQUENCY STABILITY: DRIFT RATE LESS THAN 1 PART IN 10^9 PER DAY AFTER ONE MONTH'S OPERATION.*
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vehicle combination consistent with today's rocket development. The Vanguard launching vehicle will be about 72 feet long, and 45 inches in diameter at its widest point; it will not need fins, since the engines will swivel and guidance will be supplied from internal controls—so-called "inertial" guidance. The Martin Company of Baltimore is the prime contractor for this launching vehicle, and has announced several sub-contractors.

The first stage, a liquid-fueled rocket, will be an improved Viking rocket, developed and built by Martin for NRL (SIGNAL, March-April 1956, page 75). It will be powered by a 27,000-pound thrust rocket motor, being built for Martin by the General Electric Company. Its job is to serve primarily as a large-scale booster for the other stages.

The Second Stage Rocket

The second stage is also a liquid-propellant rocket that attaches to the forward end of the first stage and also carries in its nose (which is the nose for the entire vehicle) the third stage and the satellite payload. The propulsion system including the integral fuel tanks for this second stage is being built for Martin by the Aerojet-General Corporation of Azusa, California.

The rocket motors for both the first and second stages are gimbal-mounted, free to turn in any direction. Electrohydraulic controls, which position the motors to keep the vehicle on its programmed course, stabilize the airframes in both pitch and yaw. Auxiliary jets, or jet reactors, as they are known, prevent roll of the rocket.

The second stage also contains the "brains" for the entire launching vehicle—the complete guidance system during three periods of flight: first-stage powered flight, second-stage powered flight, and second-stage coasting flight, and also the mechanism for spinning the third stage rocket.

The Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota, has been selected to build the three-axis reference system to be carried in the second-stage rocket. This system consists of gyroscopes that indicate the launching vehicle's position at any given moment in regard

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to roll, pitch, and yaw.

A magnetic amplifier auto-pilot, to be designed and manufactured by the Vickers Electric Division, Vickers Incorporated, St. Louis, Missouri, a unit of Sperry-Rand Corporation, will take its instructions electronically from the gyro reference system. It will keep the Vanguard vehicle on its predetermined course by moving the rocket motor, mounted on its gimbal (a kind of universal joint), so that the thrust of the motor will push the entire vehicle in the desired direction.

Gimbaled Rocket Motor

The relationship of the thrust of a gimbaled rocket motor to the rocket it is propelling has been compared with the relationship that a seal bears to a ball it is balancing on its nose. If the ball, for example, tends to roll off the seal's nose to the left, the seal immediately moves his nose still further to the left, thus putting himself in a position to thrust the ball back to the right. If the ball then tends to roll off to the right, the seal moves his nose to the right, thus getting it in a position to push the ball back to the left.

A gimbaled motor, moving its thrust rapidly under the direction of its control system, keeps the rocket balanced, just as the seal keeps the ball balanced.

Two contractors are working on solid-propellant rockets for the third stage: Grand Central Rocket Company, of Redlands, California, and the Allegany Ballistics Laboratory of Cumberland, Maryland. The satellite payload, which, according to present plans, will be a metallic sphere about 20 inches in diameter, and weighing 21.5 pounds, will be attached to the front end of the third stage, and may be separated when the orbital velocity is obtained. Incidentally, this third stage, if it is separated from the satellite proper, will itself become a satellite.

The U.S. Air Force Missile Test Center, Patrick Air Force Base, Florida, has been selected as the test and launching site for Project Vanguard. In Mr. Rosen's words, this is the launching system's flight into space:

"The three-stage vehicle takes off vertically under first-stage power. It ascends in a smooth curve, tilting gradually from the vertical in the

Now . . . only 1 Conversion from VHF to Audio

Hycon Eastern is now producing standard Crystal Filters with extremely high selectivity at frequencies which eliminate the need for multiple conversions. Among these are Model 13MA and Model 13MB for use in VHF FM receivers. Model 13MB may be used in AM receivers as well as in the proposed split channel FM systems. Their low insertion loss, linear transfer characteristics and non-microphonic qualities permit their location at any point of low signal level such as between the mixer and the i.f. amplifier. For FM applications Hycon Eastern has available standard Crystal Discriminators centered at 13Mc which may be used in conjunction with Model 13MA or Model 13MB.

- SMALL SIZE — ONLY 3 5/16" X 1" X 1 ½"
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- NON-MICROPHONIC
- UNAFFECTED BY IMPEDANCE VARIATIONS COMMONLY ENCOUNTERED IN TRANSISTOR CIRCUITS
- WORKS DIRECTLY TUBE-TO-TUBE OR TRANSISTOR-TO-TRANSISTOR WITH NO PADDING
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ELECTRICAL SPECIFICATIONS — MODELS 13MA and 13MB

Center Frequency: 13Mc
Bandwidth at 6 db Attenuation: 30 Kc (Model 13MA)
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Shape Factor: $\frac{\text{60 db Bandwidth}}{\text{6 db Bandwidth}} = \frac{1.8}{1}$
Power Insertion Loss: 6 db Maximum
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direction (to the east) of the intended orbit. At first-stage burnout, the vehicle is about 26 miles above the earth and is traveling at an angle of roughly 45 degrees to the vertical. The first stage separates and coasts to an impact about 230 miles from the launching point.

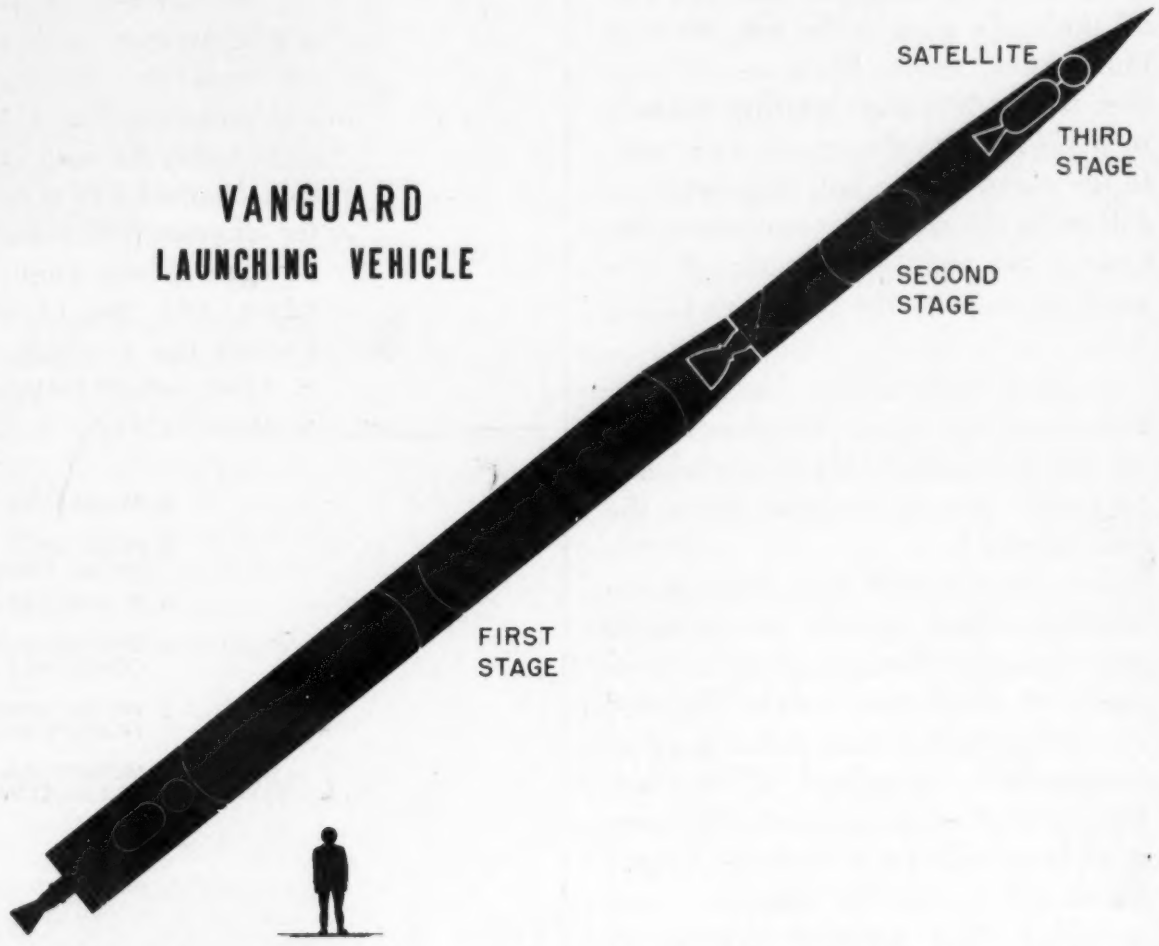
The Coasting Period

"The second stage ignites immediately upon separation and proceeds under power on a progressively inclined trajectory to an altitude of about 140 miles. At burnout it has a vertical velocity sufficient for ascent to about 300 miles altitude and a horizontal velocity that is about half the required orbital velocity (25,000 feet per second, or 18,000 miles per hour, approximately). The nose cone will have been jettisoned midway in second-stage powered flight. No separation occurs at second-stage burnout; the second-third-stage combination coasts forward a distance of about 700 miles in ascending to the 300-mile third-stage projection altitude.

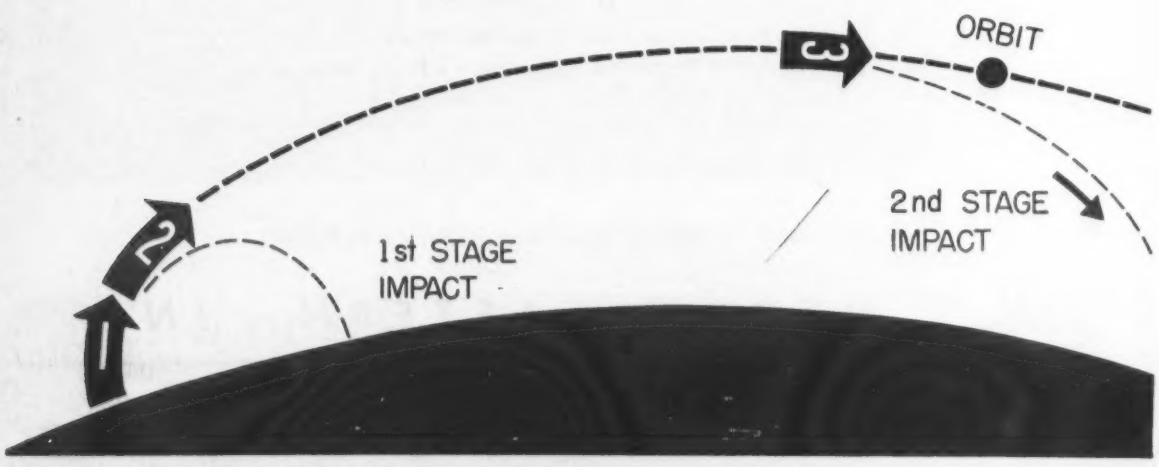
"During the coasting period, several important functions are performed. The two-stage vehicle is brought to the correct orientation (roughly tangential to the earth's surface) for projection of the third stage. Then the third stage is imparted the rotation necessary for stable flight. At this point, the vehicle is, so to speak, fully committed—no further control can be exercised. Separation of the payload, if desired, will have been previously aimed and timed to occur after third-stage burnout.

"At burning's end, the third stage will have a velocity vector of some direction and magnitude. Owing to the accumulation of errors in second-stage orientation, in sensing second-stage zenith, and in third-stage stability during firing, the final velocity vector can hardly be truly tangential to a circle. Moreover, the vehicle is being designed to have a final velocity in excess of that required for a circular orbit—this excess represents an essential margin for error. If the resulting satellite orbit lies within a perigee (nearest point to the earth) of 200 miles and an apogee (farthest point from the earth) of 1,400 miles, then the launching vehicle will have accomplished its mission."

Mr. Rosen commented that the highest velocity and altitude record for a large rocket was set in 1949 by the two-stage "Bumper-Wac". This combination reached an altitude of about 250 miles and a maximum velocity, at the second-stage burnout, of 9,000 feet per second. The Bumper-Wac's payload was about the same as is presently planned for the Vanguard launching vehicle. The fact that we now attempt to raise this payload to approximately 300 miles altitude, and give it enough velocity to establish it in an orbit—25,000 feet per second, or nearly three times as much—is, in Mr. Rosen's opinion, a tribute to our engineering progress in rocketry and in many allied fields, including electronics.



A three-stage rocket assembly, some 72 feet long and with a total weight of about 11 tons, will be required to get the scientific satellite, weighing about 21 pounds, into its earth-circling orbit.



Functions of the three stages of the rocket launching assembly are shown in this sketch of the trajectory. The first stage starts the system on its flight, drops off some 40 miles and two minutes later, after its fuel is spent. The second stage then takes over, burning out at about 130 miles altitude, and coasting on to the desired orbital altitude of 300 miles. At this altitude, the third stage places the satellite in its orbit, at a velocity of about 18,000 miles per hour. Over-all elapsed time: about ten minutes from take-off!

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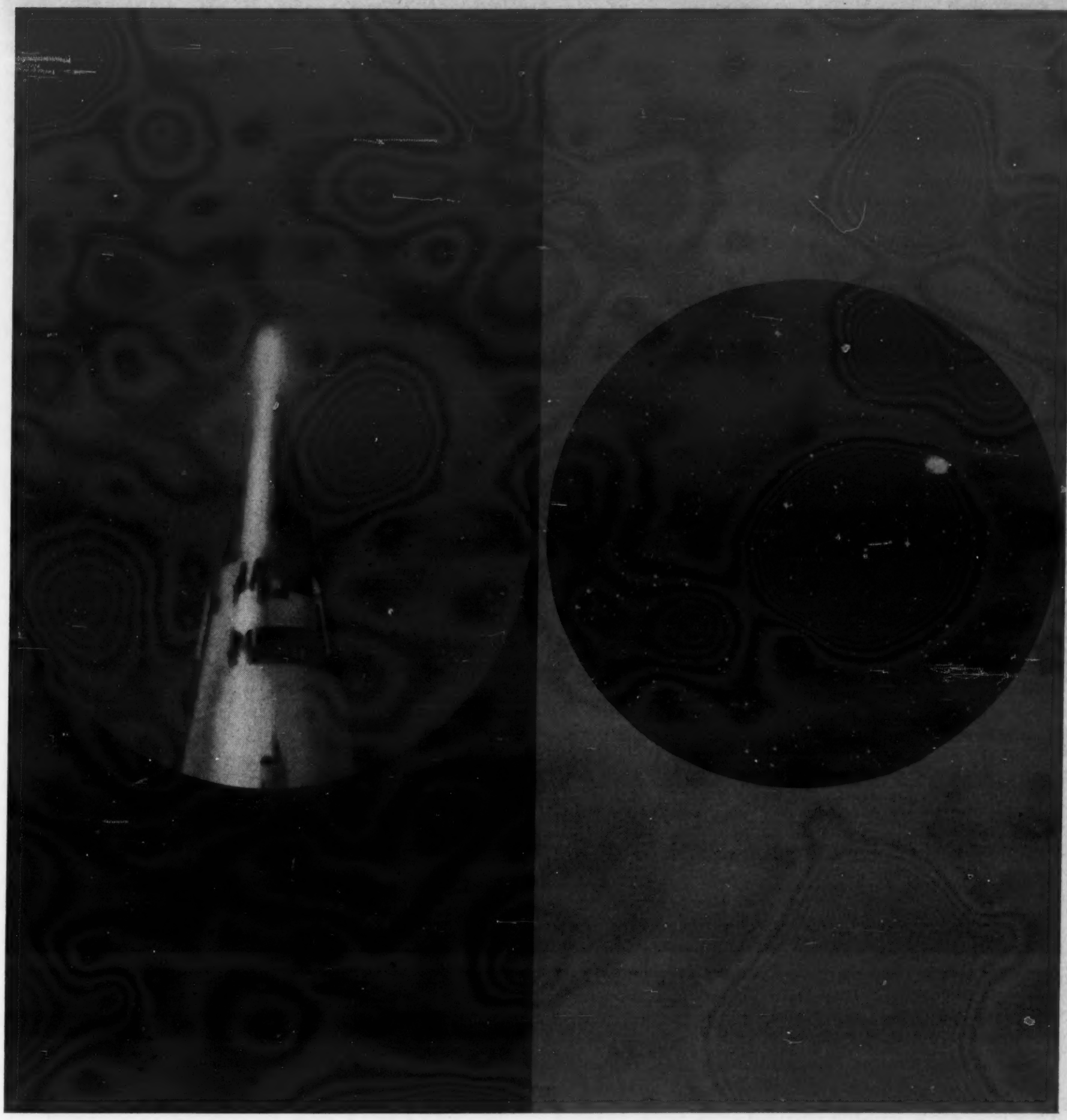


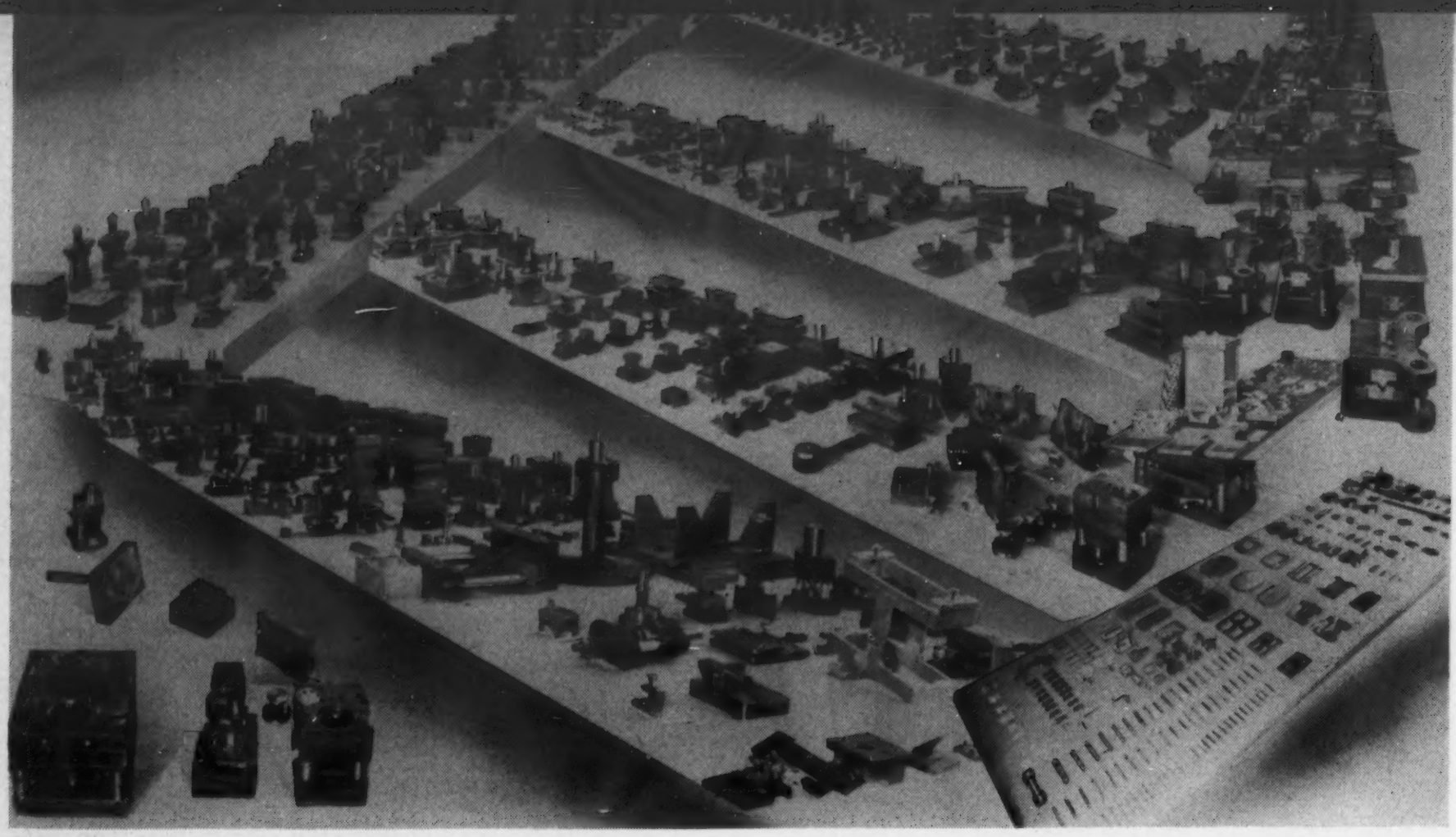
HOT TIP

One day not many months from now a Martin rocket—carrying the first man-made earth satellite—will depart this world at an unheard-of speed of 18,000 miles per hour...destination, outer space.

This coming moment in history points up a significant fact:

No other company in the aircraft world knows more today about tomorrow.

MARTIN



Tools from IT&T associates and suppliers in Europe for fabrication of GRC equipment.

Supply of Communications Equipment for International Defense

by Edmond H. Leavey

THE APPARENTLY SIMPLE TECHNICAL TASK OF supplying essential communication channels of the type most suitable for the defense of Europe has proved in practice to be as complex as any problem yet undertaken by the North Atlantic Treaty Organization (NATO).

The procurement of equipment for this purpose involves many conflicting forces that change in intensity from month to month. National pride, which quite understandably favors developments originating at home, clashes with the military need for stability, interworkability, and, in many cases, interchangeability. Political pressures to stimulate industry in areas of comparative unemployment conflict with considerations of economy in procurement. The desirability of employing the latest developments in equipment and technique must be weighed against delicate diplomatic considerations. *The whole gamut of emotions and economic forces that makes our domestic scene at times so turbulent and unpredictable is multiplied by 15 nations, 10 languages, and a complex interplay of cultural considerations.*

Tact is the first requirement of those men at Supreme Headquarters, Allied Powers in Europe (SHAPE), whose task it is to deal with communications. They must

The Author

Before being elected president of IT&T this past April, General Leavey served as a vice-president of the corporation in 1952, president of Federal Telecommunications Labs in 1953, and president of International Standard Electric Corp. from December 1954. He is a graduate of West Point and Rensselaer Polytechnic Institute.

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persuade each member nation to contribute to a new communication network for the common good, as well as to integrate its existing military and civilian communication systems with those of 14 others. Within each nation, the army, navy, and air force have important voices, as do also the departments dealing with communications, commerce, and finance—to say nothing of the chief of state and the legislative assembly over them. The need for liaison piles agency upon agency while the funds forthcoming in varying proportion from each member nation must be allocated under the most jealous supervision.

Notwithstanding the manifold difficulties, real progress has been made. Equipment has been built here and abroad to agreed specifications and, although far from complete, much of it is already installed and working. Surely this is an encouraging indication of what men of good will can accomplish in an atmosphere of freedom.

There is not space here to outline, much less discuss, the complicated series of administrative structures through which the program is being implemented. I should like to pay sincere tribute to the exellence of those structures and, more particularly, to the men who compose them, with many of whom I was closely associated and with whom it was a privilege to serve in SHAPE.

Let me now pass on to a comparatively detailed analysis of a few typical problems of "offshore procurement" by the United States that we at International Telephone and Telegraph Corporation have encountered. I shall not discuss production of equipment on direct contract. Our associated companies in Europe, like many other manufacturers there, provided our own Armed Forces on a crash basis immediately after liberation, and later under normal contract during the occupation period, with many such items as radiotelegraph and radiotelephone equipment, private automatic branch telephone exchanges, aerial navigation equipment, and even mine detectors in great quantities.

Program Aims

One of the principal aims of the U. S. offshore-procurement program was to develop European sources of supply, either for complete items of equipment or for their component parts, for our own and other NATO forces, which had to conform to exacting U. S. specifications, interwork with U. S. equipment, and, in many cases, be actually interchangeable piece by piece and part by part with U. S. equipment. *This was an essential element of the NATO concept, under which military communication equipment was almost for the first time made common to a group of nations.* IT&T, as an international organization with 33 research and manufacturing companies in 19 countries, all those abroad being owned and managed through its wholly-owned subsidiary, International Standard Electric Corporation, had already evolved a background of experience that immediately proved its value in this regard.

In 1952, we were called upon by the U. S. Navy to reproduce in Europe a radio transmitter and correlated receiver, at that time designated TED and RED. Our commitment was to produce them on a time schedule not much longer than a comparable production program would have required in the United States and to incorporate as many European components as practicality would allow.

Both TED and RED were at that time in production in one of our American plants. Our first step was to assemble and ship to one of our foreign associates twelve complete sets of knocked-down parts for each item of equipment, together, of course, with manufacturing and tool drawings and specifications. We also exchanged engineers—and at a later date, foremen—as liaison men: on the one side to learn, and on the other to iron out all misunderstandings on the spot.

Immediately upon receipt of the knocked-down parts, our European associate took half of the twelve sets of electronic components and proceeded to scour its own country and the rest of Western Europe to obtain samples of, and quotations for, corresponding European components. At the same time, it began fabricating the tools, jigs, and dies necessary for an assembly line and educating and tooling suppliers of many mechanical parts. The other six sets were used for training in assembly.

Early Problems

The first returns from the search for components were discouraging, partly because of the short lead-time allowed and the small quantities involved, and partly because foreign sources simply could not at that time fill the requirements. In order to meet delivery dates, a portion of each type of component was ordered in the United States for delivery abroad. In the meantime, potential European suppliers were furnished with Joint Army-Navy (JAN) specifications and, in some cases, with manufacturing information from our U. S. suppliers.

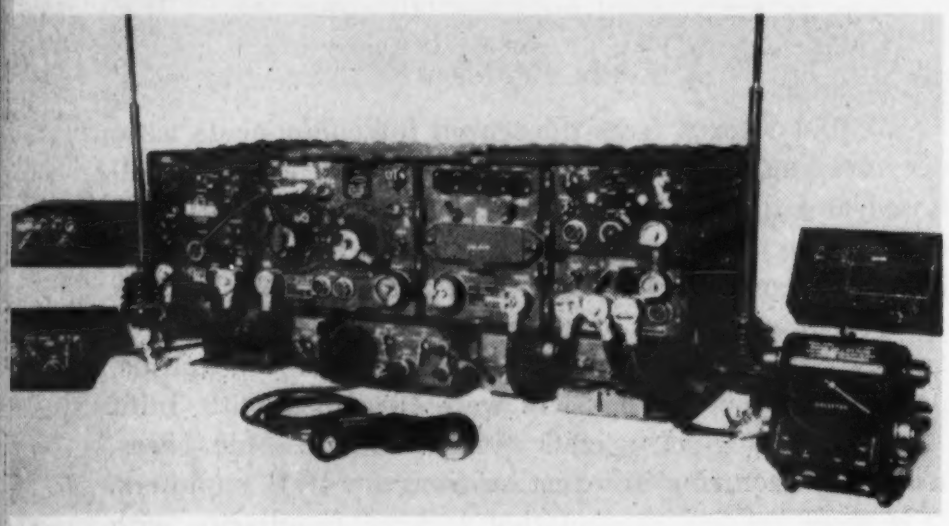
It soon became evident that lack of familiarity with JAN specifications, and lack of facilities and equipment for testing in accordance with them, would defeat the whole program. We therefore established in one of our European laboratories a special department for testing European-made components to JAN specifications. This department was manned by one or two American engineers familiar with our practice and several local engineers and technicians. In addition to testing components for our own contractors, for other European manufacturers of NATO equipment, and for the U. S. Armed Forces directly, this department undertook the job of furnishing technical assistance to European suppliers to insure that American and European equipment and components would meet the same standards.

The conversion of American measure to metric measure was quickly made and presented comparatively little difficulty. A more troublesome obstacle was to furnish American-type screw threads; this had to be overcome by importing considerable American screw machinery. Other problems met and surmounted involved various raw material and size requirements.

The Armed Services of the United States cooperated most imaginatively with us in solving numerous problems abroad. For example, where components were otherwise satisfactory, but mounting presented a special problem, the use of mounting plates or adapters was authorized. In another area of the work, U. S. Navy inspectors trained local government officials in their techniques and standards and, ultimately, relied upon their reports.

As soon as satisfactory sources for components were developed in Europe, orders placed in the United States were diverted and the corresponding European components were substituted, with the result that we were able, on subsequent contracts, to deliver TED and RED equipment for which more than 90% of the mechanical parts and electronic components were fabricated in Europe. It should be pointed out that the only reason for continuing to import certain components from the United States was that the quantity required in the foreseeable future was not enough to justify the expense of tooling up in Europe.

I think it is fair to say that our efforts contributed largely to the establishment of a respectable number of European sources ready, willing, and able to supply components to standards that meet the rigid requirements of our Armed Forces. This achievement led, in turn, to a number of further offshore contracts for our own and other companies abroad for equipment furnished to NATO nations either directly or through the Armed



GRC-5 vehicular radio communication unit comprising two transmitters and three receivers, with associated remote control equipment and power pack.

Forces. Among these was the series of contracts initiated by the U. S. Army Signal Corps, whereby other IT&T companies overseas collaborated on the GRC 3/8 series of radio receivers and transmitters and, having learned the leader-follower technique, were able to subcontract part of the work on complete equipment units to an important European competitor. For the GRC-5 assembly, 5,000 tools to fabricate 2,600 different parts were needed.

Other equipment handled by IT&T companies abroad includes CRD-6 direction-finders ordered by the Air Force in Germany for distribution to all NATO countries; microwave links and transmission equipment for the communication network of the Air Force in Spain, and tropospheric forward-scatter microwave equipment for NATO communication links in Europe. TACAN is perhaps the outstanding example of the equipment and accompanying services that can be furnished by an organization such as IT&T, with closely knit organizations in many countries.

TACAN is the TACtical Air Navigation system developed by IT&T laboratories in the United States to meet the demands of modern aviation, both military and commercial. It is based in part on fundamental concepts evolved by our scientists on the other side of the Atlantic, whose work dates back to several years before World War II. Accepted by the U. S. Navy and Air Force, and cleared for use by NATO, TACAN equipment for our allies is now being produced by IT&T factories in the U. S. and England, and preparations are being made for its production in France, Germany, and Italy. This illustrates not only the practicability of joint international manufacture of a highly complex piece of equipment to agreed standards, but also shows how IT&T can bring to bear on its work the scientific experience of many nations.

Close Cooperation Necessary

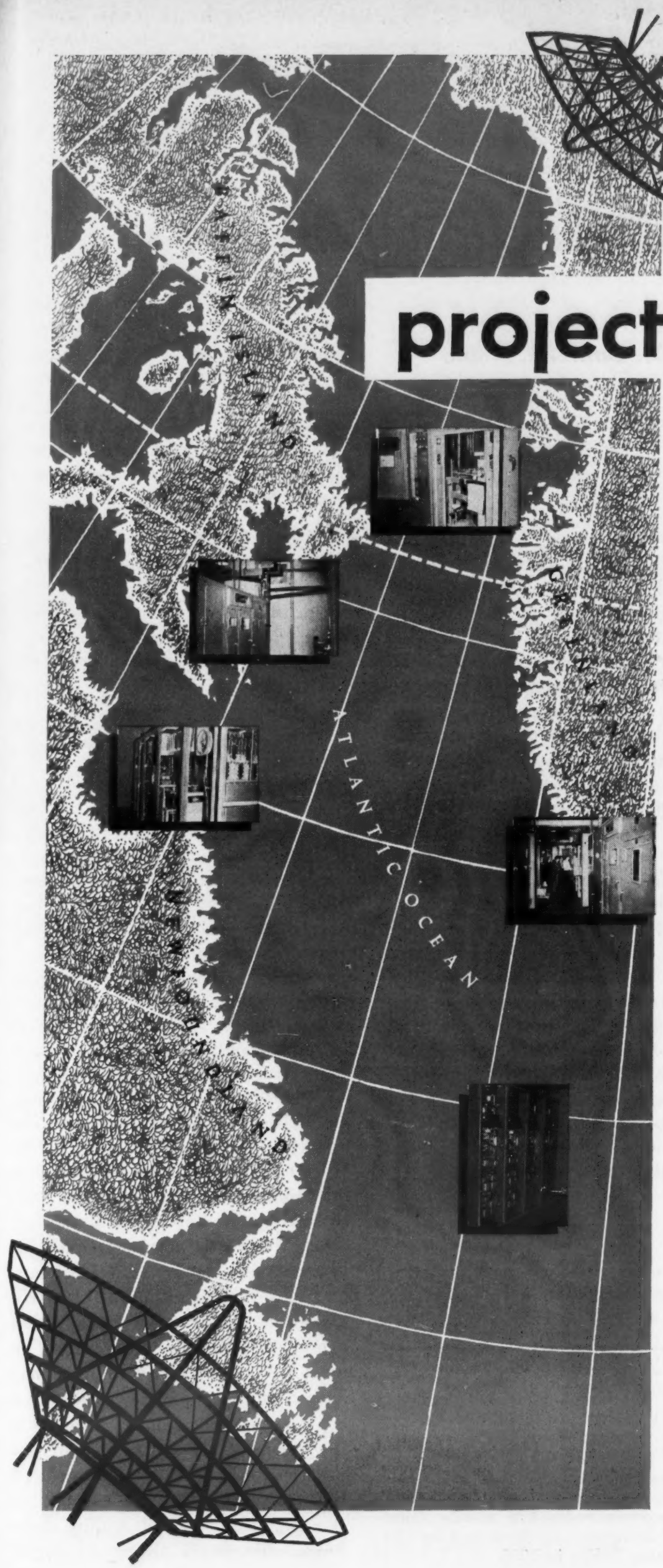
Looking back over our experience in this field, there are several conclusions to be drawn that others may find useful. We learned again the old lessan that good communication equipment is a matter of detail, and that attention to good components solves most of the difficulties with the end product. We learned again the advantage of close cooperation between individuals who worked together for many years, whether under joint management or, as is perhaps more common in the electronics industry, in a licensor-licensee relationship. We learned again the importance of testing any product on identical test equipment and of calibrating that test equipment wherever used. We learned again that in international as in domestic operations it is possible by well coordinated effort to accomplish the nearly impossible and in a reasonable time. We learned again the high caliber of available foreign resources in science, manufacture, and management. Finally, we have proved without question that free men of many nations can work together intelligently and wholeheartedly for a common objective.

Congratulations to the Armed Forces Communications and Electronics Association on the occasion of its 10th anniversary of service to the Nation.

The Association can look with just pride on its distinguished record of accomplishments and steady progress in the combined fields of communications, electronics, and photography.

The members of the Military Police Association are confident that you will continue to forge ahead to even greater accomplishments.

Robert H. Fisher / **Major, USA**
Editor, Military Police Journal
Military Police Association



project polevault

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Need was desperate for this link from Far Northern radar warning networks to defense command centers in Canada and the United States. REL managed to conceive, design, and produce all the radio equipment between February and September of 1954. This included the 10 kw Klystron amplifiers, the driver transmitters, the dual diversity receivers, and the radio test equipment.

This Herculean achievement enabled the system to operate over its entire length only 365 days from receipt of the original authorization by REL.

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Yesterday, Today, and Tomorrow in Mobile Radio Communications

by Dr. Daniel E. Noble

"WITHOUT CRYSTALS, YOU HAVE radio, with them, communications." This statement, made back in 1940 by Major (now Major General) J. D. O'Connell, characterized the most significant, courageous and essential decision affecting mobile radio communications in World War II. The Signal Corps was not only pressed to supply simple and effective mobile and portable radio voice communications, but was also required to supply eighty to one hundred channels for each set.

The academic approach to the problem suggested a stable, free-running oscillator, tunable over the band of operation. To Major O'Connell, Col. Colton, and the technical staff at Fort Monmouth, the practical, realistic solution, which would provide a communication tool rather than an engineering complex, clearly spelled out crystal stabilization. The hard-headed decision to use quartz crystals was made despite the non-existence of a quartz crystal processing industry capable of supplying even a minor fraction of the potential Signal Corps requirement. My hat is off in a token of deep respect for the men of the Signal Corps responsible for the decision to use crystals. I wish to pay my respects, in particluar, to General O'Connell, who was not only one of the chief advocates of the use of crystals for the Signal Corps mobile and portable equipment, but who also, under special assignment, planned, organized and set in motion the people and the industries who met the phenomenal demand for the production of quartz frequency stabilizers. Because of this selection of crystals for frequency stabilization, our ground forces were equipped with truly effective radio voice communications equipment which was readily operated by men without special training. I remember remarking to General O'Connell (then Colonel) during one of the field testing operations that, "A Pfc. is not required to operate this equipment; we have, at last, achieved a simplicity of control which will permit operation even by a full colonel, after thirty seconds of instructions." We proved the point before the tests were ended.

Phase Modulation

A second decision of importance was the determination to use phase modulation (popularly designated as "FM"). The record shows that the FM equipment used in World War II provided excellent communications and acceptable selectivity and operational characteristics for the state of the art.

Performance Design Improvements

We are concerned in this review primarily with the changes in equipment and trends in design which have been developing over the past ten years. Since 1940, the demands for space in the radio spectrum have increased sharply, and this need to operate more systems and more radio communications units in the same area and in the same spectrum space has influenced the design trend more than any other single factor. World War II equipment wasted spectrum space. The old designs permitted wide frequency deviations to peaks of 80 or 100 kc.; the transmitters radiated substantial spurious energy, and the receivers were responsive in varying degrees to many carrier frequencies in addition to the one set for communications. Designs have changed. Modern transmitters have been equipped with selective circuits to limit the spurious radiation. They have built-in instantaneous deviation controls to limit modulation and stop the frequency excursions into the next channel. They use quartz crystals of improved design to stabilize the frequency control within closer limits. Receivers display extraordi-

The Author

Daniel E. Noble, as vice president of Motorola, Inc., is responsible for the executive direction of all of the company activities including research, development, and production in the fields of military electronics, radio communications, industrial electronics, and the transistor and semi-conduction product fields. The first two-way radio FM mobile radio communications system was designed and developed by Dr. Noble for the Connecticut State Police in 1938.

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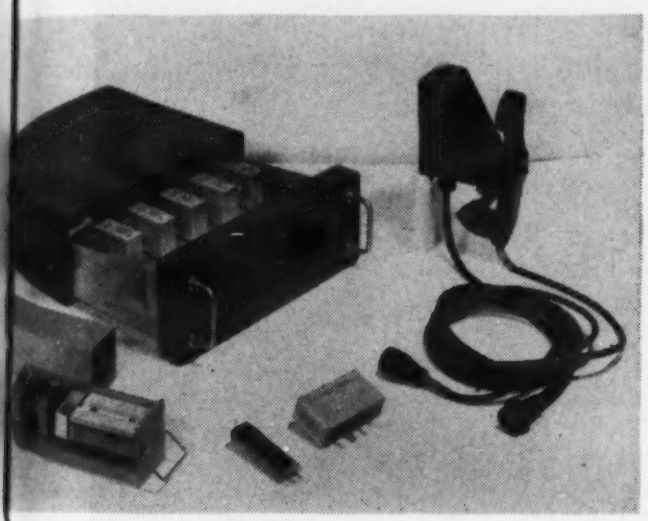
nary selectivity improvement and spurious response reducion.

The progress made in receiver design is particularly noteworthy. Spurious responses have been reduced in particular receiver designs to a point where they are more than 100 db. below the desired channel response. The I.F. selectivity has been steadily improved until attenuations as high as 100 db. are provided against the intrusion of adjacent channel signals. Control of spurious receiver response and I.F. selectivity is of great importance for the operation of equipment in a crowded spectrum, but the chief barrier to the simultaneous operation of systems employing powerful transmitters in the same area are intermodulation and desensitizing. In a heavily populated area, it is not unusual to desire communication between a base station and a mobile unit when the mobile unit is five miles from its own base station and only five hundred feet from another base station operating on an adjacent or a nearby channel. The strong signal from this opposing station tends to bias off the r.f. amplifier and saturate the mixer in such a way that the receiver loses sensitivity on the desired channel and the home base station is not received. Two or more strong opposing base station signals of proper frequency relationship can mix in the front end of the receiver to produce a product which is exactly on the frequency of the desired signal. This latter phenomenon, known as intermodulation, is a nuisance, not only in military operations but it is a very great nuisance in industrial, transportation, and safety service radio systems in the crowded metropolitan areas. Substantial progress has been made in reducing both desensitizing and intermodulation limitations of receiver performance since the end of World War II.

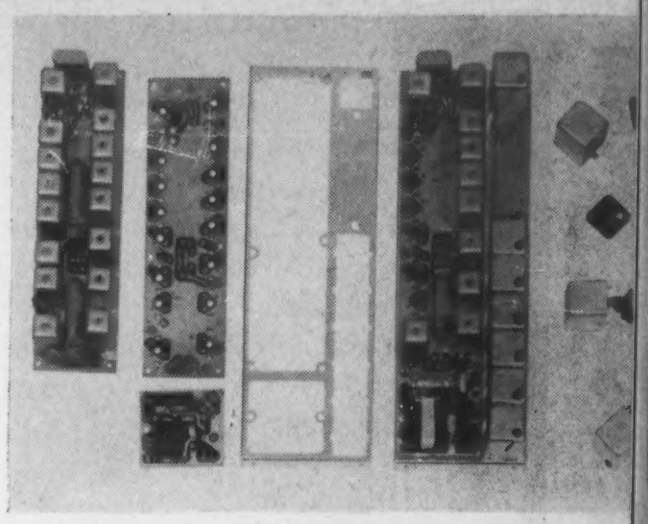


Selective calling equipment developed by Motorola for the Signal Corps enables individual or group calling of up to ten non-tactical mobile two-way radio units. Electromechanical Vibrasender and Vibrasponder resonant tone devices are utilized.

Need for Better Filters

The theoretical answer to both receiver problems would be the use of an adequate amount of r.f. selectivity ahead of the introduction of nonlinear elements, in order that the undesired signals could be eliminated before they develop the interference capability in the r. f. and mixer stages. While very great improvement has been realized over the performance specifications of the old models, it is beyond the capabilities of the present art to provide enough front-end r.f. selectivity at the VHF and UHF frequencies so that adequate protection can be achieved against the effects of desensitizing and intermodulation. *What we need is a black box with the selectivity characteristics of the I. F. filter at the r.f. frequencies.* There has been some progress in the development of crystal filters for front-end r.f. selection, but to date no satisfactory practical answer has been found. In the performance area of receiver design, the successful operation of receivers sensitive to 1 Microvolt or less in areas adjacent to powerful opposing stations and nearby channels remains one of the very important unsolved problems.

While the trends in the performance design have been directed toward improvement of the efficiency of the spectrum occupancy, the trend in the physical design has been concerned with improved reliability, modular construction, improved design for maintenance, and design for decreased weight and size. Attention has been given to the problem of producibiliay and crystal saving. Printed and plated circuitry techniques show promise of improving the potential producibility of the equipment. Crystal saver circuitry provides an extended number of channel selections from a small number of crystals.

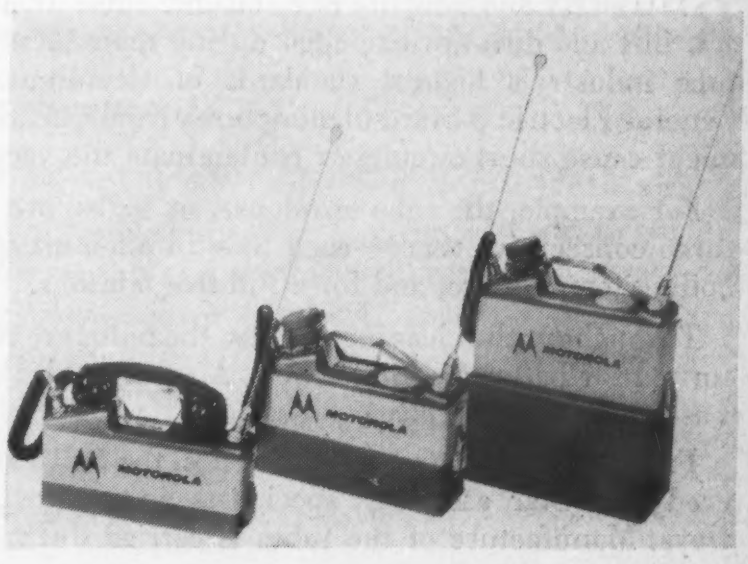


Shown above are the elements of the transistorized receiver used in the Motorola Handie-Talkie portable radiophone. From left to right are: the 144-174 mc. RF module; the printed chassis for RF and audio-squelch modules; the receiver mounting frame; the 25-54 mc. receiver including IF module with six plastic sealed circuits, and individual IF, limiter, and discriminator modules.

Use of Vacuum Tube

While the use of modular construction improves accessibility and producibility, such design also contributes substantially to the reliability of equipment. In some cases, the entire I. F. filter is permanently sealed against encroachment of moisture, shock, and maintenance men. Once the selectivity characteristics are set at the factory, they remain fixed for the life of the receiver.

(*Continued on page* 59)



Illustrated are three of the new transistorized Motorola Handie-Talkie portable radiophones. From left to right are: the lightweight, maximum portability version including handset-type microphone and standard dry battery power pack; the speaker and microphone version with extra-duty battery power pack or rechargeable nickel-cadmium wet cell-6/12 volt power pack, and the high-powered pack version with rechargeable nickel-cadmium wet cell power pack or extra-duty dry battery power pack.

IMMACULATE CLEANLINESS IN MANUFACTURE ASSURES RELIABILITY OF G-E 5-STAR SUBMINIATURE TUBES!

RELIABILITY and long life of electronic tubes increase as dirt and dust are excluded during manufacture. The tube industry's highest standards of cleanliness guard General Electric 5-Star subminiatures from particles that might cause short circuits or contaminate the vacuum.

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Progress Is Our Most Important Product

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In the development of mobile and portable equipment, one component more than any other has determined the general structural pattern. The size, weight, reliability, and maintenance characteristics have been fixed to a large extent by this essential part. This component is the vacuum tube. With the progress made in the transistor art, it is apparent to all students of the subject

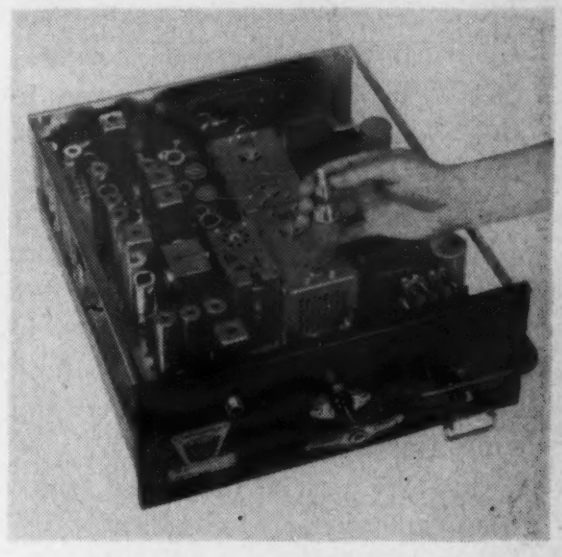
Shown above: Motorola "Power Voice" mobile speaker has a built-in transistor amplifier which provides up to 10 watts audio output when fed by the usual mobile communications receiver with 1.5 to 2 watts audio output.

that all military equipment, and particularly mobile and portable equipment, is moving toward design changes which are so substantial that they may be described as revolutionary or radical. Heat, voltage, current, and moisture are enemies of all components, and the necessary use of the vacuum tube specified construction which has favored and supported these enemies to reliability.

In receivers, the vacuum tube with its built-in furnace is responsible for the high temperatures which have become accepted as the normal operational ambient for components. Because the vacuum tube is a consumable unit of limited life, the designs must provide an open structure. The use of contact sockets and open construction expose the entire unit to damage from shock, moisture, fungus, and other corrosive influences. The high voltage required for the operation of the vacuum tubes challenges the dielectric strength of condensers and insulators, and the internal shorting capability of the tubes contributes to additional component failures under the usual high voltage and high current operating conditions of the device. With the improvement of semiconductor devices, it becomes possible to design for voltages as low as a fraction of a volt or as high as forty of fifty volts, and for currents, in low-level devices, from a few microamps to a few milliamperes. Except for power transistors, the heat-generating characteristics of this new component are negligible, and the operational life will be comparable ultimately to the usual life of quality resistor and condenser components. With this reduction in voltage, current, and heat generation, and with the substantial reduction in shock susceptibility, we now find it possible to design sealed active modules which will have the life characteristics of the modules designed with passive networks.

Future Design Trends

It might be pointed out that, in both military equipment and commercial equipment, it has been demonstrated that it is possible to seal complex precision-selectivity networks employing as many as sixteen tuned circuits with the associated condensers, resistors, and coils, and to guarantee a normal and continuous life for the assembly for a period in excess of ten years under the usual wide range of conditions encountered in mobile operation. The development of low drain, low voltage transistors gives promise of new design configurations duplicating the reliability performance of the passive module, but with active non-linear and generating components in the



Pictured above: Mobile two-way radio unit for experimental operation in the 890-960 mc. band uses new long-life type ML2C39M transmitter output tube. The unit is used in a new operation in this part of the spectum.

module. The progress made to date is most promising.

The trends in future design of portable and mobile equipment can be summarized as follows:

Electrical and physical design trends:

(1) Smaller size and lighter weight.

(2) Functional active and passive modular sealed unit construction.

(3) Effective use of transistors and other semiconductor devices.

(4) The elimination of vibrators

Special Anniversary Announcement

"May I govern my passions with absolute sway, and grow wiser and better by changing my way."

Next month SIGNAL will discontinue its present method of publishing the monthly **News Letter.** Starting on October fifteen and continuing monthly thereafter, the **News Letter** will appear as a magazine type of publication except on those dates when the regular issue of SIGNAL appears. On these dates the **News Letter** will appear as a separate section of the magazine. This change will provide a timely and interesting presentation of quick, easy-to-read material from Industry, Government, and Military sources.

and motor generators through the use of transistor-oscillator-rectifier "D. C. transformers."

(5) The use of crystal savers in conjunction with switching mechanisms which will provide fast and easy channel changes.

(6) The use of standardized plated circuit modules with substitute modules for changing frequency bands.

(7) The use of electromechanical filters for I. F. selectivity to replace electrical filters.

(8) Single conversion receivers in the VHF bands using electromechanical I. F. filters.

Performance improvement trends:

(1) Constant improvement in both r. f. and I. F. selectivity.

(2) Continuing improvement in crystal stability in terms of both rapid environmental changes and long-time aging.

(3) Reduction of undesired transmitter radiations, including modulation splatter to more than 100 db. down.

(4) Development of transistor circuitry designed primarily for reliability and including, in some particular cases, redundant circuitry where extraordinary reliability is required.

(5) The development of both selective squelch and selective signaling for reduction of nuisance interference and improvement in circuit privacy.

(6) Continued improvement in receiver performance in the presence of impulse noise.

Systems design trends:

(1) Continued exploration of forms of modulation other than AM and FM, in an effort to increase the efficiency of spectrum occupancy.

(2) The investigation of the so-called "coordinated systems" with the objective of increasing channel loading.

(3) Adjacent area co-channel operation made effective with tone selective squelch.

(4) Development of unattended repeaters powered by wind or solar battery power.

(5) More general employment of obstacle gain and forward-scatter in point-to-point circuits.

(6) Use of vertical directivity VHF antennas to reduce close-in signal level to avoid intermodulation and desensitizing.

Future Frequency Trends

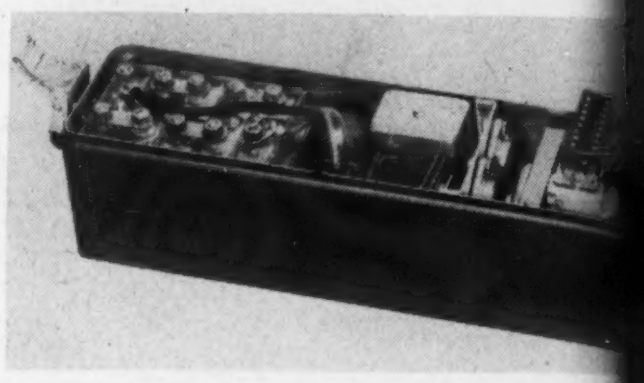
Trends in the development of new frequencies for mobile use:

(1) The perfection of the so-called "split channel operation" in both the 25-50 mc. and the 150-174 mc. regions. This will entail the adjacent area operation on adjacent channels, with no more than 15 or 20 kc. separation.

(2) The improvement in the design and operating characteristics of the so-called "450 mc. mobile bands" and the exploration and practical application of mobile communications in the 900 mc. region.

The summary of trends has been limited to the potentially rewarding areas of research and development which are clearly defined by progress in the mobile art. The more esoteric proposals are left to the unrestrained imaginations of the intellectuals who are not responsible for the job of making equipment work.

Pictured above is a plastic-sealed IF filter used in Radio Set AN/GRC-10. It contains ten tuned circuits.



Shown above: D C Transformer. A Nickel-cadmium wet cell—6/12 volt power pack for portable radiophone provides 8 hours of normal transmitter and receiver usage, and also enables operation from 6 or 12 volt vehicle battery while being trickle charged. Nickel-cadmium battery is permanently sealed, requires no refilling, and shows no degradation with repeating charging.

The Armed Forces Communications and Electronics Association, together with its magazine, SIGNAL, fills a definite and vital need. This is evidenced by its continued growth and expansion since its founding.

On SIGNAL's 10th anniversary, Marine Corps Gazette extends its sincere and warm congratulations. May the AFCEA and SIGNAL continue to grow and prosper in the years ahead.

R. D. Salmon /

Brigadier General, U. S. Marine Corps
Editor-in-Chief, Marine Corps Gazette
Marine Corps Association

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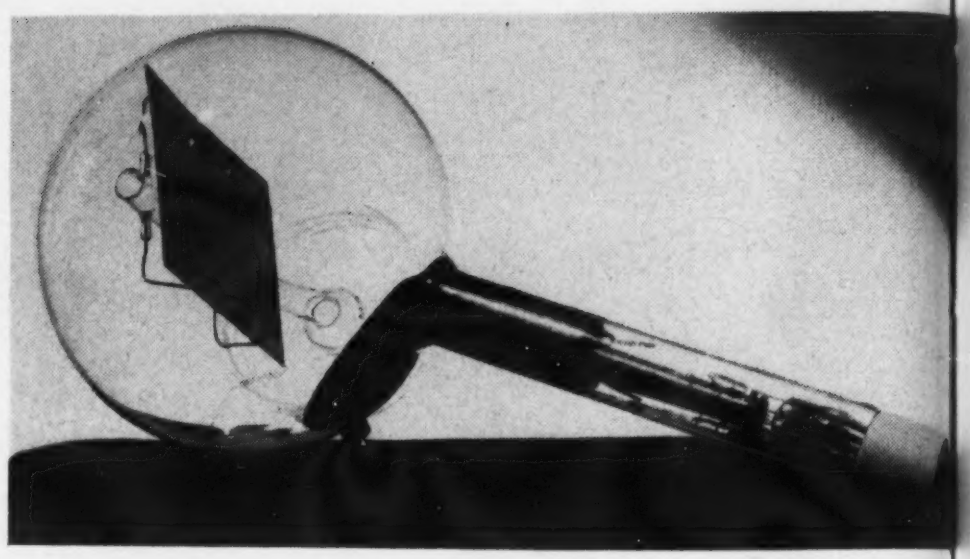
Television's Expanding Service to the Nation

by Dr. Elmer W. Engstrom



Right: For television, the real scientific breakthrough began with the iconoscope, shown here. Invented and developed by Dr. V. K. Zworykin, this was the first practical all-electronic camera.

IN THE RELATIVELY BRIEF SPAN OF ten years, television has grown from an infant prodigy of electronics into one of America's most eminent arts and industries. This tremendous advance, the result of over a quarter of a century of painstaking research and development, is fitting tribute to the pioneering scientists who made the dream of extending human sight a reality.

Today, television receivers provide nearly forty million American homes with daily programs of news, entertainment and education. Beyond this, electronic "eyes" are opening a wealth of opportunities for benefit to industry, medicine, and the entire science of military communications.

The Author

Dr. Engstrom, senior vice-president, Radio Corp. of America, is responsible today for a wide range of RCA's research, engineering and manufacturing activities.

Introduction of compatible color television, pioneered and developed by the Radio Corporation of America, is even now translating the earlier wonder of transmitted sight into vivid, life-like views of things as we normally see them. Now in an era of major expansion, color television commands increasing public attention, and its effectiveness assures its future growth in many non-broadcast fields as well.

Early Research

Progress of television — in black-and-white and color—covers a long period of patient and skillful research and development. Research requirements alone, in the beginning and for more than three decades, were so enormous that only those imbued with an intense pioneering spirit continued to pursue the complex and challenging art.

Early workers in television were extremely limited as to picture definition because of the wide frequency band requirements. The advent of sensitive photocells and effective electron tubes for amplifiers provided a spurt in development during the early 1920's. For television, however, the real scientific breakthrough came with Dr. Zworykin's invention and development of the iconoscope as an all-electronic camera tube and the refinement of the cathode-ray tube for picture reproduction.

There followed almost a decade of painstaking research and development of apparatus together with controlled experimentation to develop an understanding of the transmission and reception of radio signals for television. Each advance in apparatus and transmission was subjected to intensive and extensive testing in the field, trying the system under the conditions of service and use. To all of this, many research scientists and engineers made contributions.

Television was first introduced as a service to the American public in 1939 by RCA and the National Broadcasting Company. On that historic occasion Brig. Gen. David Sarnoff, now Chairman of the Board of RCA, declared: "And now we add radio sight to sound. It is with a feeling of humbleness that I come to

this moment of announcing the birth in this country of a new art so important in its implications that it is bound to affect all society. It is an art which shines like a torch of hope in a troubled world. It is a creative force which we must learn to utilize for the benefit of all mankind."

Growth and Development

In 1940, television soared into the air to give the groundling viewer his first aerial look at a great city in history's first public demonstration of telecasting from an airplane. In this demonstration, RCA transmitted from an aircraft flying over New York, a television picture of the city which was rebroadcast by NBC. This first airborne TV experiment was followed by extensive Army and Navy programs by RCA during World War II resulting in the use of television as a medium for the guidance of early airborne missiles as well as for reconnaissance purposes.

By the war's end in 1945, the technological advances achieved in wartime gave fresh impetus to the television scientists and engineers. Techniques and equipment devised or improved under the pressure of war were turned to the development of a nation-wide television service.

The full extent of television's phenomenal growth can best be brought into perspective by the situation ten years ago. In that year of 1946, as RCA introduced the first post-war television receivers, there were fewer than 10,000 sets in the country. Television broadcasting was conducted on a meager few-hours-a-week basis, and there were but six licensed television stations.

In five years television sets had passed the ten million mark, and by the start of 1956 this number had been increased four-fold. From the handful of TV stations on the air at the start of the post-war expansion, the number has risen to nearly 500, covering the major markets in the Nation with regularly scheduled network and local programs. Television set manufacturers have increased correspondingly from the few pioneers in the beginning.

Television's vigorous emergence as a public service has been accompanied by an accelerated study of possible applications in other areas where extended sight can prove beneficial. RCA, with more than 20 years of experience in developing and testing television equipment for the Armed Forces, recognizes that many segments of industry and a wide range of military functions have need for electronic "eyes."

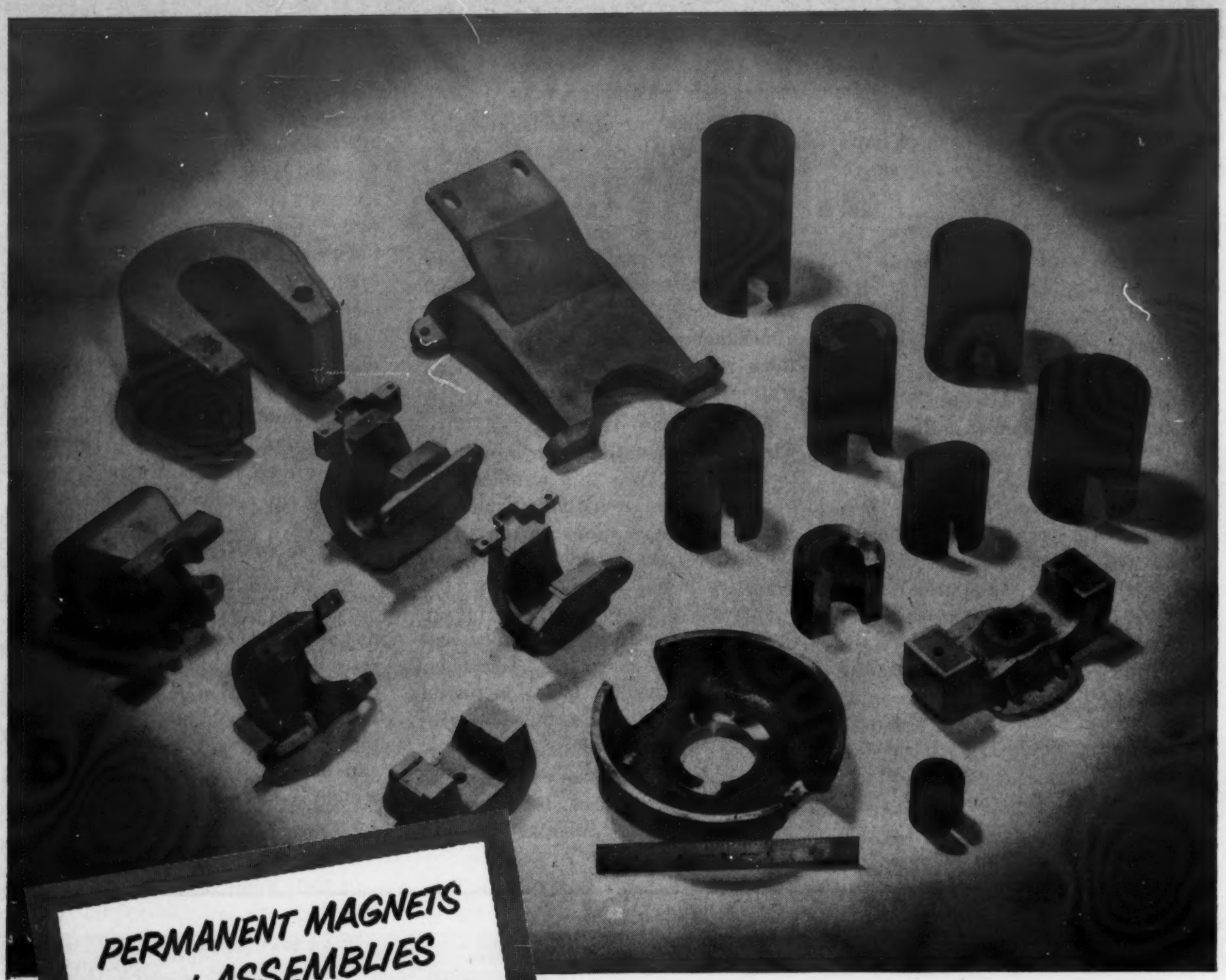
Closed-circuit television systems, together with smaller, more compact cameras, have become realities for industrial and military use. Sharper vision has been obtained with revolutionary new pickup tubes. Complete television systems have been developed to meet the most exacting commercial and combat needs.

Use in Remote Viewing

As an aid to industry, television "eyes" are providing an inexpensive means for remote viewing of processes, locations, and operations where direct observation is too dangerous, too hot, too cold, too inconvenient, too confining, or too costly. Pictures can be picked up by a small, lightweight camera and transmitted by a

(Continued on page 65)

Above: Television was first introduced as a service to the American public in 1939 with a telecast by Brig. Gen. David Sarnoff, now chairman of the board, Radio Corporation of America, from the World's Fair Grounds in New York.



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single cable to the control unit and receiver monitor which may be located at a distance. By using more than one camera, a single observer may watch a number of widely separated points and through the use of multiple receivers, observers at different locations can all view the same scene simultaneously. Close-ups of experiments, demonstrations and microscopic studies can be enlarged and projected for more convenient and comprehensive viewing by large groups.

Industrial and Military Uses

In the development of industrial television, engineers and users of electronic "eyes" are discovering almost every day new applications for this valuable extension of human sight. Among the numerous applications are those by commerce and banking, industrial control and testing, surgical operations and medical training, security and law enforcement, and such widely diversified uses as fire control, forest conservation, rescue work, nuclear research, and traffic control.

At the same time, important advances are being made in the development of television for military applications.

Two years ago this summer, at Fort George G. Meade, Maryland, the first full scale public demonstration of combat television was presented by the Signal Corps and RCA. Before the display ended, it was evident that the military and electronic sciences had once again brought from the need-and-idea stage to fruition a development of potential value to national security.

From hand-carried, jeep-conveyed, and airborne television cameras, details of the rapidly developing mock military maneuver were transmitted to a receiver-equipped command post. Watching through the eyes of television, the commander was able to see and control the battle situation, quickly, comprehensively, as action and crisis developed. In addition, the use of standard color television equipment in one phase of the exercise emphasized the potential value to the field commander of color transmission as an even more effective tool for identification and terrain study.

The combat exercise demonstrated in a highly realistic setting the tactical uses that are within the capabilities of today's experimental battlefield television equipment. These uses, explored by the Signal Corps over the past years during its development of training techniques and equipment, include the following:

(1) Location, evaluation, and designation of artillery targets.

(2) Adjustment and control of artillery fire.

(3) Transmission of data from the combat area to headquarters.

(4) Reconnaissance of enemy-held territory to detect supply points, assembly areas, and movement of forces.

(5) Intelligence reporting, such as examination of captured personnel and equipment.

(6) Briefing of tactical commanders before an action by showing terrain, routes of approach, and enemy positions.

(7) Observation and control of amphibious landings, river crossings, and assaults, as well as the movement behind the lines of friendly troops and supplies.

Portable TV Station

This Ft. Meade demonstration is one of several developments in military television. Early this year, the Signal Corps revealed that RCA had developed and built to its specifications a truly portable television station which will enable a soldier to scout battle action and enemy movements and transmit the information directly to television receivers in a remote command post.

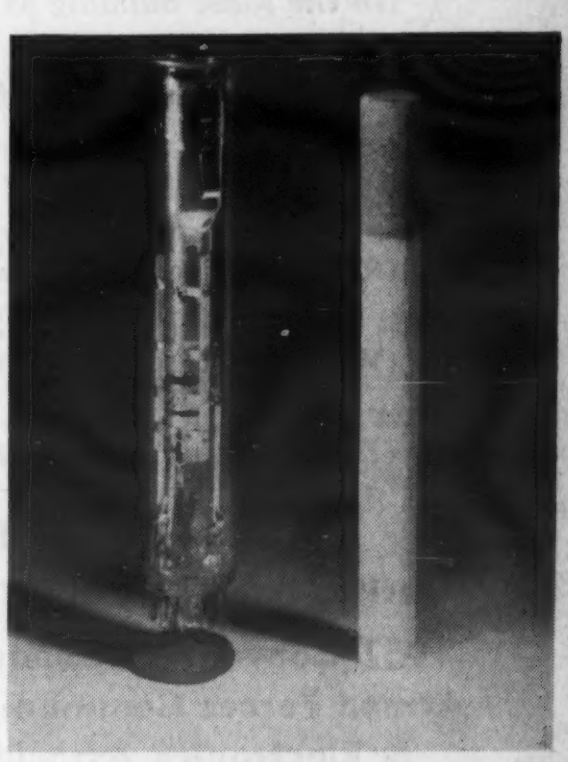
Called the man-pack television system, this recent development involves a hand-held, eight-pound TV camera and a back-carried, 47-pound TV transmitter with a built-in power supply. The equipment enables a scout to televise scenes for transmission to receiving or re-transmitting points from one-half to one mile away.

Even more advanced equipment of this type may be put to military use in the near future. Only a month ago, a highly portable transistorized camera and transmitter was shown by RCA Laboratories and was put into use by the National Broadcasting Company in news coverage of the national political conventions. The development unit comprises a four-pound camera equipped with a detachable electronic view-finder, and a 15-pound back-pack transmitter with a range of approximately one mile. The camera employs a new, and as yet experimental, RCA-developed ½-inch Vidicon tube of good sensitivity and performance.

Light Intensifiers

Of considerable promise, too, to more flexible and effective military television is a developmental "wide-spaced" image orthicon tube, or television camera tube, demonstrated by RCA in May of this year. This tube can be used for televising scenes and objects under light conditions as low as those of a moderately cloudy or moonlit night. This developmental tube gives promise of numerous military applications and is being used experimentally by the Services.

Recently, also, public announcement was made of the "Cat Eye" electronic light-intensifier, resulting from research by RCA in conjunction with the U. S. Air Force. This device is capable of viewing objects in almost total darkness to produce clearly defined television pictures. In fact, the Air Force has announced that the "Cat Eye" enables airmen to see in



No longer than a king-size cigarette is this RCA-developed experimental ½-inch Vidicon pick up tube. Featuring good sensitivity and performance, it is used in the new transistorized portable television camera.

the dark with almost daylight clarity, and that it is expected to become a valuable aid to the Air Force as a reconnaissance device.

Hospital Use of Color TV

In a large sense, "military television" is too narrow a term to describe television's contributions to the military services, since it implies only battlefield use. Television serves the Armed Forces and the Government in many non-combat functions as well.

The Nation's first installation of compatible color television for hospital use is being made by RCA to serve three Government medical activities located at the Walter Reed Army Medical Center, Washington, D. C., and will be in operation before the end of the year. Representing the largest compatible color television system so far developed for non-entertainment applications, this comprehensive installation will provide three complete color television studios for use by the Armed Forces Institute of Pathology, the Walter Reed Army Hospital, and the Army Medical Service Graduate School. The system will be utilized for research, training, and consultation purposes and, ultimately, will be expanded to connect other Government hospitals and medical installations into a medical network for exchange of information and services.

TV in Medical Teaching

The AFIP is the central laboratory for the U. S. Army, Navy, and Air Force, as well as other Government agencies. It also instructs military personnel in pathological procedures and provides a nation-wide consultation service for military and civilian pathologists. It will use its color TV system to further research, teaching, and consultation services, while the color system at Walter Reed Hospital will be utilized primarily for teaching and the demonstration of surgical practices.

The Army Medical Service Graduate School provides military medical personnel with instructions in latest medical, dental, and veterinary techniques. There, the color system will provide camera pickups in operating rooms and classrooms, and will permit projection of demonstrations from central locations to various classrooms.

Closed Circuit at NACA Lab

Another application of potential military significance is the installation of an RCA closed-circuit TV system at the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics, which is devoted to advanced research on aviation equipment and flight techniques. At the NACA laboratory, closed-circuit television enables engineers to observe, remotely, the performance of aircraft models and engines in wind-tunnel tests.

Off the coast of Florida, closed-circuit television equipment permits the U. S. Fish and Wildlife Service, Department of the Interior, to observe and test the performance of experimental fishery methods and equipment under actual oceanic conditions. This application clearly demonstrates television's facility for working under water, and its potential as an aid in salvage and repair operations, and, possibly, in naval underwater operations.

Classroom Television

At the U. S. Naval Academy at Annapolis, television for educational purposes has been installed to aid in the instruction of midshipmen. In 19 electrical engineering department classrooms at the Academy, television receivers serve as a supplementary means of instruction. The chief virtue of educational television, according to the Academy, is that one in-

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Above: Color Television cameras of the type shown here suspended over an operating table form a part of the closed-circuit color system being installed by RCA at the Walter Reed Army Medical Center.

Left: An example of the versatility of closed-circuit television is this installation at NACA's Lewis Flight Propulsion Laboratory to permit remote observation of model aircraft and engines in a wind tunnel.

structor can lecture simultaneously in scattered classrooms, and midshipmen can view demonstration of objects which cannot otherwise be studied satisfactorily because of location or size.

At Limestone, Maine, and nine other out-of-the-way bases, the U. S. Air Force has installed low-power television transmitting stations to provide entertainment for base personnel and families.

In these, and many other ways, television is aiding the Armed Forces.

Military television today is demonstrating graphically its ability to serve the Armed Forces in the air, on the sea, on the battlefield, in hospitals, and in educational and training centers. However, its capabilities for service hardly have been tapped. Military television, like most electronic developments, is ever changing and expanding.

In the immediate future military television for both combat and service applications can be expected to take on new shapes and dimensions, to utilize the latest advances in electronic science, and to extend its fields of application, compactness, and portability.

Prospects for Tomorrow

The military outlook for tomorrow must include color television cameras and transmitters sufficiently small and compact to be carried into combat by a single soldier-scout, to be taken aloft by plane or helicopter, and to be located unobtrusively for remote operation and observation on the battlefield. Transistors and other miniaturized electronic components will play important roles in reducing military TV equipment in size and weight for greater mobility and transportability in the air and on the ground.

Modern military forces eventually will depend to a great extent on countless electronic "eyes" of television that see by night and day, with realism and detail.

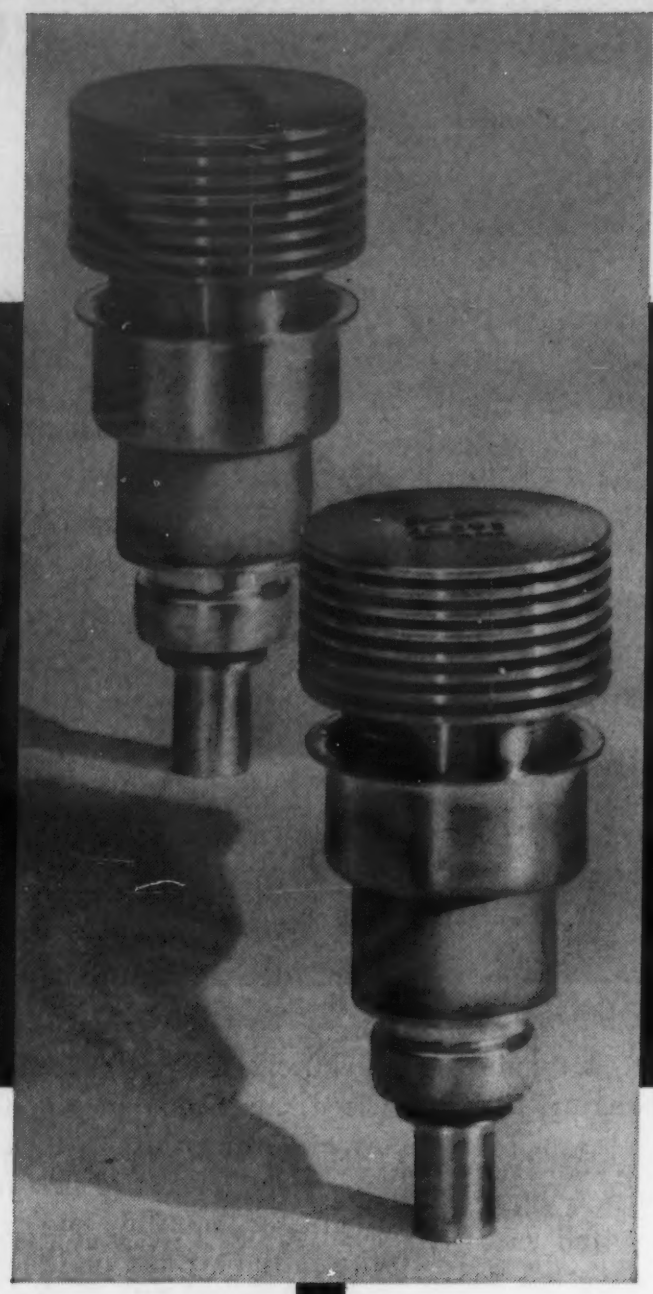
Television for industrial and medical uses is destined for major growth and ever greater versatility in its applications. And color television—as the newest mass communication medium—will be extended rapidly across this nation and eventually across the seas for service to people in many lands.

The Armed Forces Chemical Association learns with much interest and pleasure of the attainment by the Armed Forces Communications and Electronics Association of its 10th anniversary and extends to that Association its sincere congratulations.

My best wishes for your continued progress and achievement for national defense.

Sincerely,

Glenn A. Hutt / **President**
Armed Forces Chemical Association



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THE ARMY Signal Supply System

by Brig. Gen. James Dreyfus, USA

DURING WORLD WAR II AND THE KOREAN CONFLICT, the primary problems of supply were associated with getting the goods into the supply system and distributed to the troops. The Nation's industrial plants and the Army Supply System combined to assure that desperately needed equipment was available where and when it was needed. The one objective was to get goods to the troops; any inefficiency involved in speeding up this process was worth the price. The Nation still expects outstanding performance from the Army Supply System, but the problems of today require the kind of miracles which mean doing more with less.

The element of cost now permeates the thinking of supply managers at all levels. But the application of cost to management decisions is not an easy one, since we must reckon with the unknown future. If we knew that an enemy attack was imminent, the Nation would assume a war footing to gain maximum security regardless of cost. But if this present climate of international tensions goes on indefinitely, or better still, if the Nation is able to deter an enemy attack so that war never takes place, the cost of maximum security would seriously strain our economy. Somewhere a compromise must be reached to maintain a strong peacetime Army and be able to expand many-fold to meet wartime needs. Meanwhile, the task of supply management is to appraise and control the cost of supply without impairing the ability to supply on time and in required quantities.

Operating Costs are $53 Million Yearly

In the four depots handling Signal supplies in the United States, the value of stocks on hand exceeds $1.1 billion. This sum represents borrowed money against which the Government pays interest charges amounting to 3 per cent. This inventory is associated with other cost factors, such as storage space required, maintenance performed, and preservation charges. The operating costs for these four depots, numbering more than 8,900 people, are $53 million annually. Excessive inventory also raises costs associated with obsolescence, deterioration, and eventual disposal.

It is plain to see from these figures that the Army Signal Corps' responsibility for managing its supply system deals with large sums that must be carefully watched for efficient and economical operation. The Army has instituted many management tools to aid supply personnel in this regard. Among the most noteworthy are Financial Property Accounting and the Stock Fund introduced in 1954. Financial Property Accounting has provided for the first time an accurate evaluation of inventory on hand and measurement of inventory turnover by commodity class. Under this arrangement dollars become symbols for men and materials enabling supply managers in the Army to appraise the effectiveness of each operation in a manner similar to industry.

Effective Inventory Control

The Stock Fund encompasses supply items with high turnover and is not only an effective control of inventories but is used as a means to finance their acquisition and maintenance. It is a revolving fund wherein the Signal Corps "sells" the Army items to the field armies, and posts, camps and stations, utilizing the funds received to replenish depot stocks through procurement from manufacturers. At the same time, the Stock Fund represents a step in the direction of consumer funding. This means that the "consumer" utilizing the supply items must determine his own requirements and consider alternative uses of funds used to buy Signal equipment.

Through the media of these two management tools, the Signal Corps, for the first time in its history, knows the dollar value of its world-wide stock. We know, dollar-wise, what portion of it is in operating condition; or what is available for mobilization in case of the outbreak of an emergency; the amount on procurement, the short-

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The Author

General Dreyfus was appointed to his present post as Chief, Personnel and Training Division, Office of the Chief Signal Officer, on August 23, 1954, after graduating from the Industrial College of the Armed Forces. He previously had been assigned to Ft. George Meade, Md., as Signal Officer of the Second Army.

ages, excesses, etc.; all of this information is available by location of the stocks. Reports received from all Signal installations keep us informed of all changes in our supply system providing the data that enables us to take corrective actions when necessary.

Great strides have been made not only to keep costs down but also to improve the supply service to customers throughout the Army in the continental United States and overseas, the National Guard, the reserve components, such as the USAR and ROTC, other branches of the military establishment, etc.

Present Signal Corps requisition processing procedures are streamlined through:

a. Reduction in depot editing of requisitions. Depots are not required to edit for basis and authority requisitions for low dollar value stock fund items or for items contained on authorized station stockage lists.

b. Use of the transceiver network to determine availability at secondary sources, thus reducing time consumed in extracting.

c. Decentralization of control of approximately 60 per cent of regulated items to the depot level, reducing the number of extracts to supply control points for administrative approval.

d. Reduction of the number of accountability points for depot stocks to four.

e. Decentralization of procurement to stations and depots of over 7,000 commercial type Signal Corps items.

f. Scheduling arrival at depots of normal replenishment requisitions to provide a leveling out of requisition processing workload.

g. Direct submission of requisitions to key depots by requisitioners.

Signal Corps requisition processing procedures are flexible enough to allow, in addition to normal supply, expedited processing for different types of emergency demands. Evaluation of supply performance is made through analysis of distribution operations reports compiled from information furnished by depots and by overseas supply agencies in the case of overseas supply support.

Use of Data Processing System

In keeping with the general trend in electronic development, the Signal Corps, as a user, has developed a comprehensive and aggressive plan to exploit fully Electronic Data Processing Systems within the supply and logistic fields. The Signal Corps' effort, in this area, is typical of the philosophy, interest, and aggressiveness of the Army technical services; therefore, it will be described briefly.

The Signal Logistical System is a world-wide system, consisting of a national stock control point, CONUS Branch Depots, post, camp and station activity and overseas depots. Stock assets exceed one billion dollars. Transactions at depot level and higher, amount to thousands of items per day. The system is mechanized and operates on standardized procedures; however, the limitations of the mechanical equipment, the volume of transactions and the multiplicity and complexity of the items handled dictate a large clerical force performing a

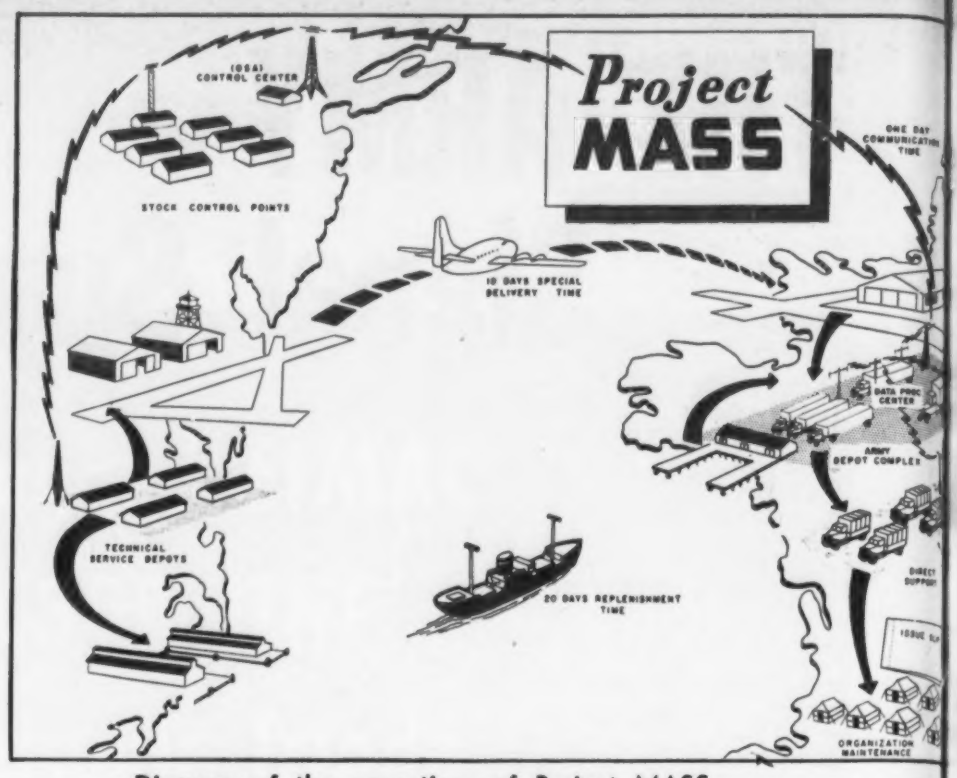

Diagram of the operations of Project MASS.

tremendous amount of repetitive type tasks. The over-all Signal Corps plan is aimed at timely processing of transactions, better management of stocks, faster supply actions, economy of operation, expandability for mobilization, and a completely integrated, responsive, compatible and flexible data processing system, any major segment of which can take over control in the event of loss of the national stock control point or a depot.

National Stock Control Point

The Army Signal Supply Agency (TASSA), the Signal Corps national stock control point, located in Philadelphia, programmed and prepared for the installation of an IBM 705 electronic data processing machine dedicated on 15 August 1956. A program designed to provide EDPS at each of four CONUS Branch Depots, on a compatible basis with each other and the national stock control point, has been finalized for implementation during the fiscal year. Initial EDPS investigative studies are currently under way at post, camp and stations, and overseas Signal depots.

To provide for a means of data communication between points in the Signal supply complex, use is being made of the transceiver. The transceiver utilizes a standard punch card as input, and electronically transmits to a distant terminal the intelligence punched in the original card. A built-in self-checking feature minimizes errors in transmission. Transceivers may be used on telephone, telegraph, or radio circuits. These devices have been installed at each branch depot and The Army Signal Supply Agency, and the network will eventually be used to transmit:

(1) new balances to TASSA;
(2) shortage reports;
(3) advices of availability;
(4) requisitions and extracts;
(5) due out notices;
(6) daily transactions;
(7) supply status, and
(8) other special projects.

The transceiver is already being utilized for transmission of new balances from depots to TASSA and for

transmission of extracts on overseas requisitions. Plans are under way for the expansion of the transceiver to cover transmission of all the information enumerated above. The use of the transceiver will result in more accurate and up-to-date availability records in TASSA, minimize re-extracts, lessen the order and shipping time between depots and requisitionists, and provide more accurate and timely supply data to users.

Presently under test is an operation known as Project MASS. The word "MASS" was derived from the first letters of the system the project is designed to test, namely, "Modern Army Supply System." This system was designed by George Washington University in conjunction with supply personnel from all the technical services and will be used to furnish repair parts for overseas supply. The system is being installed and supervised by the Deputy Chief of Staff for Logistics.

The three basic elements are: the Army Field Stock Control System, the latest in communications, and expedited transportation. The system provides for the stockage of fast moving items at the using unit level with slow moving items stocked farther to the rear. Service is provided in lieu of the previous method of stocking a wide range of items. The criteria for stockage is based on the Army Field Stock Control System. Items are requisitioned over the transceiver and expedited shipment via air or surface is effected. Those items authorized for stockage by the direct support units are duplicated in the overseas depot and again at the CONUS depot. The Tobyhanna Signal Depot, Penna., has been designated as the CONUS support depot. Duplicate stockage at Tobyhanna is being built up, and approximately 96% of the items appearing on the current stockage list are available. Ordnance and Chemical Corps started the test 1 July, and Engineers, Quartermaster, and Signal Corps began the test 1 August.

Supply Network

As the electronic communications agency for the Army, the Signal Corps is aggressively pursuing the development of an integrated digital data transmission system. Such a system will provide flexibility, efficiency, and economy. This system will operate similarly to a telephone system. A network has been designed by the Signal Corps which will provide this service to all Army users. The primary advantage of such a network to the subscriber is that it provides him access to a depot, terminal, or control point, on an "as required basis." The primary advantage is that maximum use is made of all available communication lines. The network will consist basically of five switching centers all interconnected by long distance telephone type circuits. Calls will be routed from subscriber to subscriber in the same manner as a long distance telephone call is established.

In conclusion, one fact is apparent: the modern Army cannot function if outdated logistical systems are employed. Although the Signal Corps' program and the program of the other technical services will suffer the disadvantage normally accruing to a pioneering effort, the end result should provide each technical service with a greater capability to perform their primary mission—that of maintaining the combat readiness of the Army.

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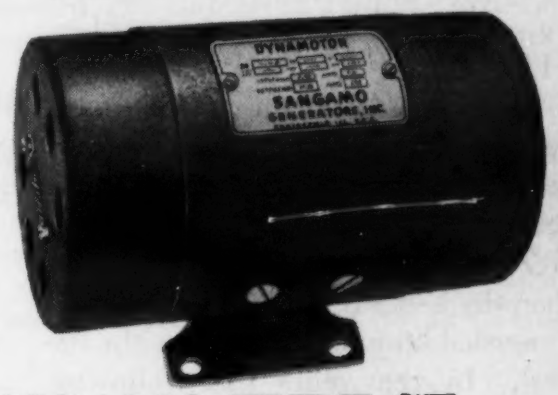

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WESTERN UNION and NATIONAL DEFENSE

by Walter P. Marshall

NO REVIEW OF OUR NATIONAL defense structure would be complete if it did not reflect the vital role—past and present—played by Western Union in the defense of this country. From its very beginning, prior to the Civil War, Western Union has been inseparably associated with the national defense.

The first transcontinental telegram, sent on October 24, 1861, by Stephen J. Field, Chief Justice of California, to President Abraham Lincoln and expressing the loyalty of that state to the Union, was sent over a coast-to-coast line built by Western Union in three months and 20 days, at a time when the Federal Government urgently needed communication with the West. In the years that followed, probably no other single invention played a greater part in the development of this Nation than the telegraph. The rapid evolution of a national telegraph system, and the fast, dependable communications that it made possible, helped to extend the railroad systems, opened new markets, stimulated the Nation's commerce, and expanded the frontiers.

Today, more than ever before, Western Union is indispensable to the national economy and a vitally important arm of our national defense system. It has been and is the company's purpose to maintain a strong, healthy, and progressive telegraph system, one that will serve the economic and social needs of the American people and be quickly responsive to every requirement of the military, in peace and in war.

Before examining the role Western Union is presently playing in the national defense picture, it may be well to review the contributions made by the company during World War II. During that period, Western Union was called upon to handle more than 7,000 special telegraph projects for war purposes, including the development of special equipment to meet military requirements, the adaptation of existing equipment, and many special research assignments.

Telegraph "know - how," research, and development contributed to the solution of many problems confronting the military services. These involved, among others, the development or adaptation of special automatic equipment and circuits to meet specific military requirements. These included radio multiplex, Telekrypton, Telefax, Varioplex on ocean cables, and special reperforator switching projects; the development of concentrated arc light sources and optiphone light beam communication apparatus for the Army; the development of bore-sighting equipment for airplane armament; the construction of pilot trainers for the Navy, etc. More than 10,000 skilled Western Union employees went into service with the Armed Forces, and other military personnel received communications training at special centers established and maintained by the telegraph company.

The decade that followed World War II has seen a remarkable expansion of the services and facilities provided by Western Union to the public, the civilian Government, and the military. During that period, the company has completed a vast nation-wide mechanization program, which has revolutionized telegraph methods and doubled the peak wartime capacity of its plant. Concurrent with the mechanization program, Western Union has carried out a vast expansion of F.M. carrier facilities which insure a highly stable form of operation. It has built the world's first commercial, super-high-frequency microwave beam transmission system and introduced facsimile in telegraphic and business operations on an ever-widening scale.

Liaison with Armed Forces

In the field of military communications, Western Union maintains constant liaison with the Armed Services in Washington. Our staff in that city includes Rear Admiral Joseph R. Redman, USN (Ret.), who was director of Naval Communications in World War II, and Brigadier General Paul L. Neal, USA (Ret.), former commanding officer of the Signal Corps Engineering Laboratories at Ft. Monmouth. Both men act as communication consultants for the company and assist in coordinating our

(Continued on page 74)

The Author

Under Mr. Marshall, president since 1948, The Western Union Telegraph Co. has doubled its World War II message capacity. He is a national director of AFCEA.

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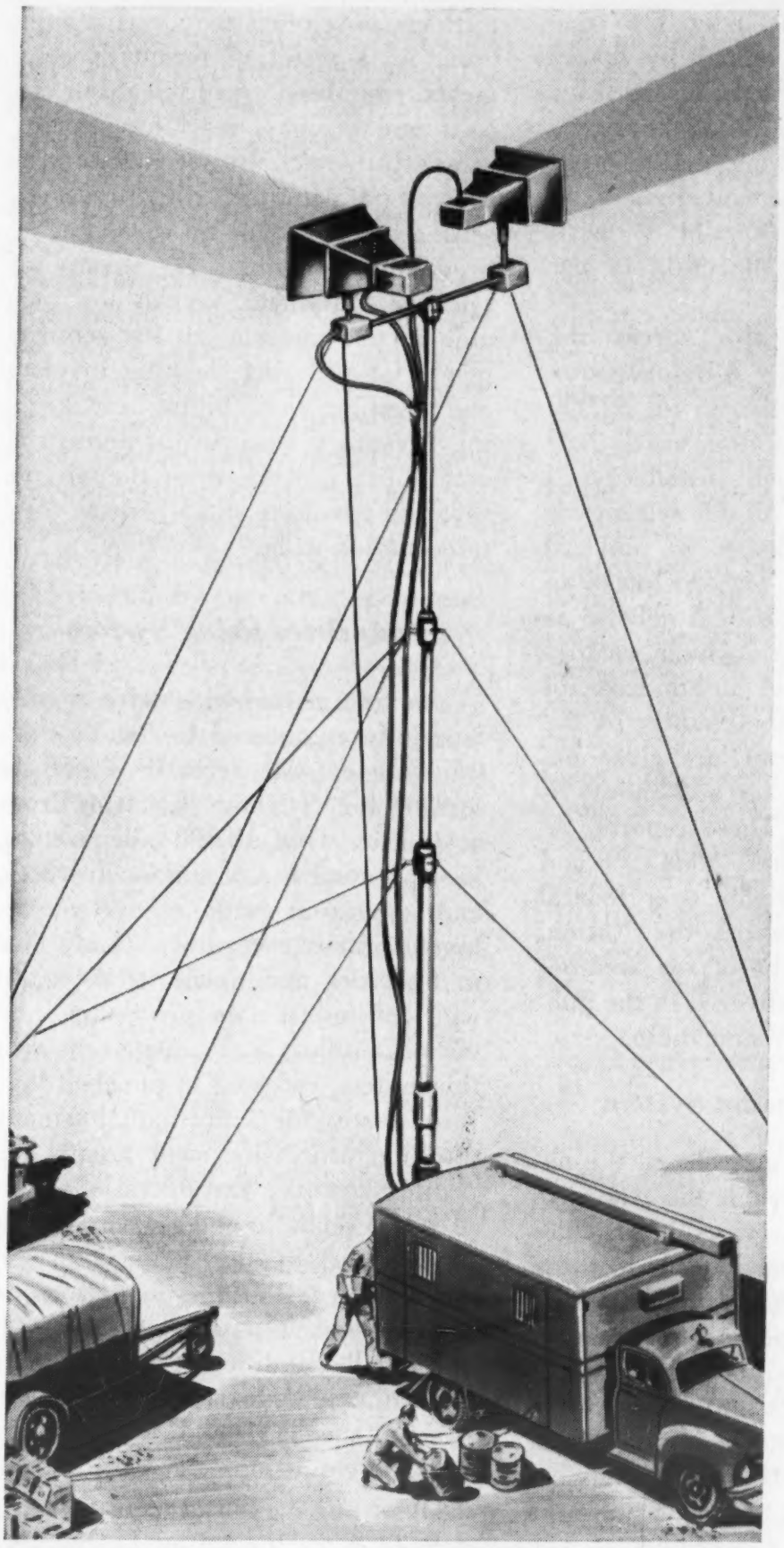
Portable . . . Rugged . . . Reliable Communications

RCA's Type MM-18 Mobile Microwave Package provides the ideal portable communications system, designed specifically to complement the modern concept of mobility of equipment. Truck-mounted terminal and repeater equipment of highest portability and simplified construction permit rapid assembly of stations for in-service operation within minutes after site has been established. Proved in rugged emergency operations under conditions of adverse weather and terrain, since 1952, RCA Mobile Microwave performance matches the reliability found in fixed stations.



EASY-TO-SERVICE FAMILIAR CIRCUITS ★ READILY AVAILABLE TUBES ★ SINGLE SIDE-BAND SUPPRESSED-CARRIER FREQUENCY-DIVISION MULTIPLEXING ★ ALL APPLICABLE FREQUENCY BANDS BETWEEN 1700 AND 2700 MC ★ OPTIONAL STAND-BY EQUIPMENT

REPEATER EQUIPMENT—

The RCA Radio Repeater Assembly is the heterodyne type—acclaimed the finest type repeater yet developed. Provisions are included for inserting and dropping voice channels or teletype channels on a party-line basis. A handset, provided for service channel operation, includes push-buttons and buzzers for signaling at each station. The rugged power supply serves both halves of a repeater. Metering facilities and test points are provided on the radio equipment to permit checking operation of equipment during normal use. A wide variety of rack assemblies can be provided, ranging from a single thru-radio repeater rack to a complete multiplex arrangement.

TERMINAL EQUIPMENT—

The terminal includes one transmitter and one receiver, together with power supply and service channel equipment. In addition, an automatic frequency control panel maintains the transmitting frequency. Since repeaters are the heterodyne type, this AFC unit controls the frequency of the entire system—through to the remote terminal station.

ACCESSORIES

Complete radio station, including truck-mounted terminal, truck-mounted repeater; tower with or without emergency power compartment; prefabricated shelter for mounting on suitable truck chassis or to be set on ground; horn or parabolic antennas and other accessories. Complete information on request.

RCA MICROWAVE

POINT-TO-POINT COMMUNICATION

Performance proved in more than a million channel miles of operating systems throughout the world

Radio Corporation of America
Communications Products, Dept. J-291
Building 15-1, Camden, N. J.

☐ Please send me literature on RCA Mobile Microwave.
☐ Have an RCA representative contact me.

NAME _____ TITLE _____

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RADIO CORPORATION of AMERICA

COMMUNICATIONS PRODUCTS • CAMDEN, N. J.

domestic and international facilities with the needs of military and Government departments, particularly with respect to national defense and security matters. Earl D. Pitt, general manager of Western Union's Southern Division, is currently serving the United States Department of Commerce as Director of the Communications Division of the Business and Defense Services Administration. The study and mobilization of plans and programs will be part of his duties. Our officials, nation-wide, are also working closely with state and federal Civil Defense authorities in connection with operational plans during any emergency, and Western Union's engineers are continuously available to the military with respect to the highly specialized communications problems of the Armed Forces.

AF Private Wire System

The world's largest private wire system, the 200,000-mile network linking Air Force bases throughout the country, was designed, built, and leased to the Air Force by Western Union. Our engineers recently designed new automatic communications centers for this system which will further increase its speed and efficiency. Each message will be typed only once at the place of origin and will flash automatically, arriving in printed form, to any Air Force base in the world served by the system. The entire domestic Air Force network, and others combined with it, will be linked through five centers, providing completely automatic operation between all Air Force stations. Other major communications projects for the Air Force are presently under development.

New multi-point, selective signalling equipment has been designed and built for the Signal Corps, and FM carrier telegraph terminal equipment also has been developed for distant overseas communications.

In addition, we are undertaking for the Signal Corps, a project for evaluating and forecasting the best methods to handle the Army's future record communications based on developments in telegraphy as they may be expected to exist three to ten years from now. Training courses are also being conducted for military personnel to acquaint them with management problems, including theory, maintenance, and operation of automatic telegraph switching equipment.

Space limitations will not permit, unfortunately, the description of a wide variety of other projects bearing upon military and defense preparedness with which Western Union is currently engaged — the development of new communication devices for the National Security Agency, and other classified projects related to communications problems in the Government communications field.

Key Government agencies whose activities are closely related to national defense are served by large-scale private wire systems leased from Western Union. The General Services Administration, linking major civilian functions of the Government, is served by a 15,000-mile Western Union system interconnecting 53 major cities.

Western Union also serves the Civil Aeronautics Administration with a private network of 32,000 miles of circuits serving nearly 700 stations coast-to-coast. Installation of high-speed printers on this system has greatly increased its speed and capacity. The C.A.A. network plays an important role in national defense as the medium through which weather conditions, observed at hundreds of points throughout the country by the U.S. Weather Bureau, are given national distribution on a 24-hour, 7-day-a-week basis. These reports, revised every few hours, guide civil and military aircraft flights over federal airways that crisscross the Nation, and provide the basis for weather forecasting data delivered to the public by the press, TV and radio.

Data Processing System

Western Union also serves the national defense through the extensive communications services it provides to business, and particularly to those industries that are the backbone of the economy in peace and the producers of vital military materiel in war. Among the outstanding communications developments since World War II has been the tremendous expansion of private telegraph networks for industry and Government. The leasing of Western Union's private wire systems has increased five-fold in the past seven years, and that growth is continuing at a rapid pace. Facilities serving these systems are presently in excess of 2,200,000 miles, a 25% increase during the past 12 months.

Western Union pioneered the adaptation of private wire systems for data processing and this development is contributing importantly to national defense by speeding the handling of all types of paper work through automation methods. The slow handling of large volumes of paper work has long been a serious bottleneck in the overall production process, and new communication methods now offer an effective solution. As a result of recent developments, combinations of telegraph circuits and business machines already can perform such diverse functions as controlling manufacturing processes, setting printers' type by wire, and reproducing pictures. By means of selective equipment, we can now provide in one message all the requirements for ordering, making invoices and shipping tags, billing and keeping inventory records for industrial and military users, even though the separate operating units may be scattered nation-wide.

Industries Using System

The first nation-wide wire system especially engineered to handle data transmission was recently placed in service for Sylvania Electric Products, Inc. This 18,000-mile system, incorporating many unique features, and operating with almost superhuman intelligence, links 71 stations in 61 cities and towns in 20 states with Sylvania's data processing center at Camillus, N. Y. Data sent over this system, received in punched tape form ready for immediate business-machine processing, will greatly expedite Sylvania's vast operations, part of which relate to defense work. This new network applies the principles of automation to business operations on a scale never before attempted. It will handle 50 different kinds of data — production, distribution, cost, etc. —simultaneously and without the slightest confusion.

Other key industrial firms active in defense work, including U. S. Steel, General Electric, and Reynolds Metals, are also using Western Union private wire systems adapted for data processing.

UMI

The use of facsimile for rapid record communications has been another notable development since World War II and one of increasing interest to the military services. I am proud to say that Western Union is the world leader in this rapidly expanding field of ultra-modern "picture" communication, which is now operating in more than 25,000 customer offices throughout the country. Private facsimile systems, under the general name "Intrafax," are being leased to business, Government and military users for the fast transmission of a wide variety of communications between departments, branches and offices. Our newest letter-size Intrafax transmits over short or long distances typed, written, printed or pictorial matter never before susceptible of telegraphic or telephonic transmission.

Intrafax is now in operation experimentally for the United States Air Force Strategic Air Command, linking Offutt Air Force Base in Omaha, Nebraska, with the Air Materiel Command at Wright-Patterson Air Force Base in Dayton, Ohio, a distance of 1,136 miles.

Air Force bases in California, Georgia, Ohio, and other points are served by Intrafax systems used largely to speed the pick-up and distribution of communications within the base areas. Intrafax is also serving the military in Washington between the Chief Signal Officer's headquarters in the Pentagon and the Munitions Building. Another Intrafax system for the Signal Corps connects the Pentagon with Chambersburg, Pa., 80 miles distant.

Large-size facsimile equipment for transmitting weather maps has been developed for the Navy; this consists of a continuous-type recorder which permits unattended reception of weather maps and charts.

Research in facsimile is developing new, more efficient machines and methods for sending messages automatically in picture form. Today, the transmission of record communications by printer or facsimile is limited only by the circuit capacity applied. We can look forward to a future when radio beams will carry facsimile pictures of thousands of communications instantly, automatically, and with unerring accuracy.

Microwave Radio

Microwave radio, pioneered for commercial telegraphy by Western Union and now an all-important feature of the Nation's total communications picture, is firmly established in our domestic telegraph system, and its development continues. The world's first radio beam communication system to be operated commercially by any common carrier was completed and placed in operation by Western Union in 1948. Linking the heavy-volume message centers of New York, Philadelphia, Washington, and Pittsburgh, this system has a potential capacity of 2,000 simultaneous message transmissions — or 1,000 telegrams a minute in each direction. This system, which provides operating security out of and around high priority target areas, is now being extended westward to Cincinnati and Chicago, and further expansions are planned. These extensions will add almost 1,000 channels to these important cities and will provide augmented capacity to keep pace with the continued rapid growth of private wire and Intrafax systems in the heavily industrialized Mid-West area. The capacity of the existing beam system was doubled recently by equipment of improved design developed by Western Union engineers.

Over the Horizon Techniques

In the microwave field we also are experimenting with "over the horizon" transmission techniques. Use of large reflector antennas and high power makes it possible to beam ultra high frequency waves into the troposphere where they are reflected or scattered up to distances from 100 to 200 miles. This represents an important advance over the line-of-sight principle of existing microwave networks where the earth's curvature limits transmission distances to about 30 miles.

Western Union has more than doubled its capacity since World War II, through use of carrier equipment which has expanded channel facilities by more than 2,000,000 miles without adding physical wires or landline cables. We are presently operating 3,840,000 telegraph channel miles for message services, having added 324,000 miles in the past 12 months. Two-thirds of the total mileage was derived from use of FM carrier equipment which enables us to obtain up to 20 telegraph channels from one voice frequency channel.

On the occasion of the 10th anniversary of the Armed Forces Communications and Electronics Association, we of the Association of Military Surgeons of the United States wish to extend hearty congratulations.

Communication is part of life, and electronics is an ever-growing part of communications. Both form an important part of the Armed Forces. You can be justifiably proud of your part in your service to those Forces.

We wish for you every success for many times ten years.

Robert E. Bitner

Colonel, USA (Ret.)
Secretary
Association of Military Surgeons of the United States

'no sweat' when the 'heat's on'!

HYPER-SENSITIVE INFRARED SYSTEMS are part of a highly active research program at Texas Instruments. Basic investigation into crystalline optical materials puts TI at the forefront in development of infrared systems and techniques.

INFRARED APPLICATION is just one outstanding aspect of Texas Instruments *systems engineering* abilities. TI's Apparatus Division is also producing transistorized military equipment with size and weight reductions as high as 100 to 1! For airborne installations in particular, this miniaturization design approach means greater reliability, larger pay loads, longer ranges, and deeper penetration for more positive results.

FOR WELL OVER A DECADE, Texas Instruments has been building radar, sonar, and other systems for search, communications, navigation, missile guidance, and fire control... frequently to accelerated delivery requirements. Facilities for continuing progress in *systems engineering* and manufacture include over a third of a million sq ft of plant space in an excellent dispersal area.

FOR FUNDAMENTAL DESIGN and development... for manufacture of reliable systems that save weight, space, and power ... for scheduled commitments delivered on schedule... call on TI application engineers. Write to Apparatus Division...

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE DALLAS 9, TEXAS

Steady progress is being made in providing thousands of business firms, many of them suppliers of vital military materiel, with direct-wire connections giving them immediate access to Western Union's high-speed message network. There are now nearly 50,000 customers equipped with teleprinter and desk-corner facsimile machines called "Desk-Fax," a major contribution to faster, more efficient telegraph service.

In the international field, Western Union now has in service the largest number of channels ever employed in its transatlantic cable system. New deep-sea cable amplifiers, developed by Western Union engineers, have doubled the capacity of our North Atlantic cables and 40 channels are now available to the British Isles compared with 21 in 1950. These half-ton electric signal boosters, the first application of underwater electronic equipment in submarine direct-current telegraphy, have provided general service betterment, improved stability of operation, and increased maximum-security channels to meet expanding Governmental and public needs. The amplifiers permit cable operation up to three times former speeds and further increases in speed are in prospect.

The Age of Electronics

Despite the revolutionary accomplishments of the telegraph industry during the past 10 years, we have barely penetrated the outer fringes of electronic discovery. Perhaps tape transmitters of the future will be made with minute photo cells actuated by light beams instead of mechanical linkage of pins, springs and contacts; facsimile systems may employ magnetic wire recorders or recorders with magnetic rubber belts; telegraph relay contacts may be sealed under glass in vacuum tubes, permitting them to operate faster and for long, maintenance-free periods.

Certainly we are entering a new age of electronics and nucleonics, an exciting period rich with the promise of further advancement and discovery. Just as certainly, continued advances in the telegraphic art will insure that Western Union's future contributions to the national economy and the national defense are even greater than in the past.

AFCEA History

(*Continued from page* 13)

signed as executive secretary and editor of SIGNAL and was succeeded by the late Colonel George P. Dixon, who in 1953 became executive vice president of the Association and continued as editor of the magazine.

The AFCEA every year holds a "Chapter of the Year" contest designed to stimulate chapter activity and reward those chapters which have achieved outstanding success in their localities. The plaque to the winning chapter is presented each year at the annual convention.

Another AFCEA project is the presentation every June of awards at the U. S. Military Academy and the U. S. Naval Academy to the graduate with outstanding grades in the electricity courses. The awards include honorary membership in the Association.

At colleges and universities where there are ROTC programs, the AFCEA awards a medal and honorary membership to the outstanding graduate in electrical engineering. This year, 197 medals were presented at 122 colleges and universities.

Membership in the AFCEA is open to American industrial organizations, to Armed Services personnel, and to all men and women who are American citizens and interested in furthering the aims and purposes of the AFCEA. Associate membership is offered to nationals of other countries under certain conditions.

The Armed Forces Communications and Electronics Association fills a definite place in the Armed Services and in industry in the fields of communications, electronics and photography. It offers its members an opportunity to take an active part in preparing for the defense of the free world in time of an emergency, and a chance to stimulate and keep alive interest in a most vital phase of our national security—industrial preparedness.

How About It?

SIGNAL would like to take this opportunity to extend an invitation to each of its readers to submit an article for publication and thus become associated with our publishing activities. It is our conviction that the more individual participation we have from our reading public, the greater will be our reader interest and the popularity of your magazine. This is not to say that we are pinched or in crying need of articles to be published—quite the contrary. What we are saying is that your special background in a particular field should be made available for the enlightenment and increased knowledge of all our readers. What would be nicer than to have your special material presented by you and in your magazine?

We recognize that many of you may not wish to take time from your busy schedule to write an article. This is understandable. If this be the case, why not jot down your thoughts in rough draft (team up with a friend if you desire) and let us do the window dressing. This will be strictly *entre-nous* and we guarantee that when your material is published under your name, you will feel more than rewarded for your efforts.

We look forward with anticipation to a welcome acceptance of this invitation both from our membership at home and abroad. Please accept our special thanks in advance for the article which will make SIGNAL your magazine.

Our Developing Military Strength

(*Continued from page* 29)

reassuring. While our stockpile of nuclear weapons is certainly larger and more versatile and our production rates are greater, their quantity of air vehicles of all types is the greater, as is their rate of production. This, of course, raises the question of the adequacy of our rates. Many factors are involved in arriving at a judgment. I am not adequately informed about some of these factors, nor am I qualified to weigh them, so I can offer no views on the question of relative rates of production. In the naval area, as stated earlier, our Navy is much more versatile and powerful but their construction rate is considerably greater than ours, at least in some significant areas.

Military strength is dependent on the basic science and technologic strength of a people. For the very long range, the evolving scientific and technologic strength of the Russians and ourselves must be compared to gauge the future military balance. Russia has forged ahead most rapidly in its scientific and technical strength in both quality and quantity of effort. The quality of their scientific and technical effort has been realized through the splendid training their scientists and engineers receive, and they are educating many more than are we, thus narrowing the large gap of only a decade ago.

We are increasing the number of scientists and engineers in training at a very slow rate. With the demands of military research and development and of our dynamic civilian economy, there is now a great shortage of trained manpower in both science and technology. In the contest of the free world with Russian-inspired Communism, there is no action for increasing the Nation's strength of greater continuing importance than that of providing an adequate number of sufficiently trained scientists and engineers to meet the expanding and ever-more exacting needs of civilian and military technology.

Electronics—Modern Jinni

(*Continued frfom page* 18)

carried 1,500 pounds of electronic equipment. The interceptor of today carries 2,400 pounds and the end is not in sight.

This increased use of and dependence upon electronics by the military has created a number of problems. There must be a compromise between simplicity and performance and reliability and the weight-space factor. The military talks of ruggedization, unitization, standardization, miniaturization—and even subminiaturization.

This is the sort of task which must be given to a jinni. Without this jinni of electronics, the United States never would have achieved its present position of leadership and prestige in the community of nations. In order to keep this top position, our scientists must continue to rub harder on the magic lamp of research as they bring us tomorrow's electronic miracles today.

ANOTHER EXAMPLE OF:

What our creative engineering can do for you

Creative engineering is evident in the Stabilized Communications Transmitter — Stacot — which Westinghouse designed and is producing for the U. S. Navy. Take the accessibility feature shown at right, for example. Each major unit pulls out like a drawer and rotates about its horizontal axis to permit access to all four sides for checking and servicing. In effect, the transmitter serves as its own workbench. Simple? Yes — but to the electronics technician working in the close quarters of a radio room it seems like a stroke of genius.

To achieve *reliability,* the Westinghouse design philosophy is based on simplicity. For example, the number of electron tubes has been reduced by 30% from existing comparable transmitters.

Design achievements such as these, and there are dozens more in Stacot transmitters, are typical of the creative imagination that goes into every electronics design problem Westinghouse tackles. These jobs are our meat because of the breadth of experience Westinghouse has — not only in communications, but in every phase of electronics. Name your problem — we have both the highly imaginative young engineers and experienced electronic pioneers to solve it. Write or phone today. Westinghouse Electric Corporation, Electronics Division, Baltimore, Md. Telephone EDmondson 6-2300.

J-02301

THE WESTINGHOUSE ELECTRONICS FAMILY

Communications, Radar, Missile & Interceptor Control, Data Handling & Display, Electronic Counter Measures

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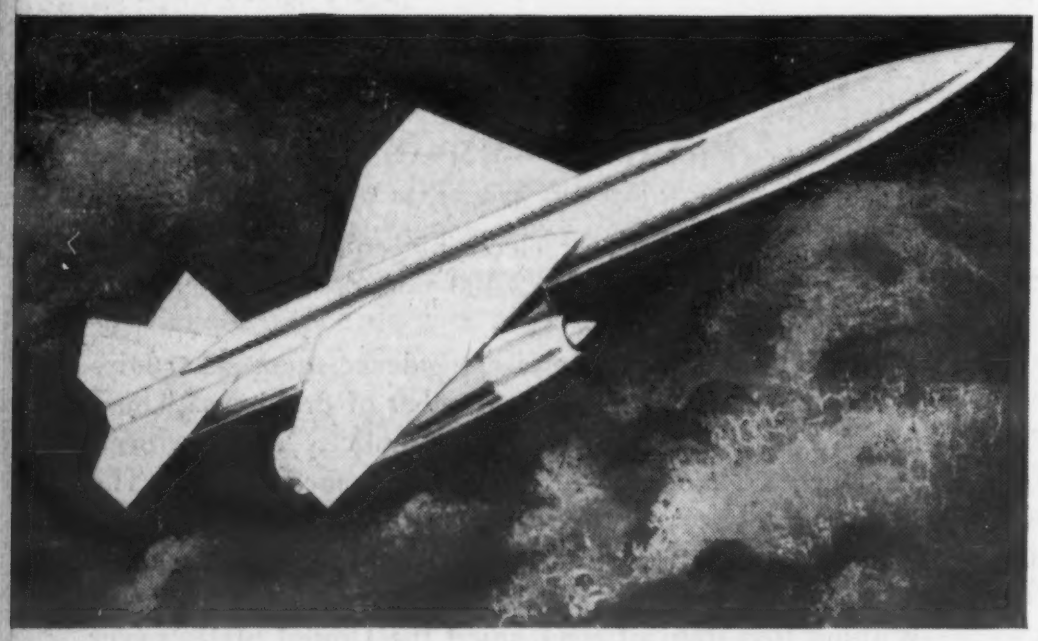

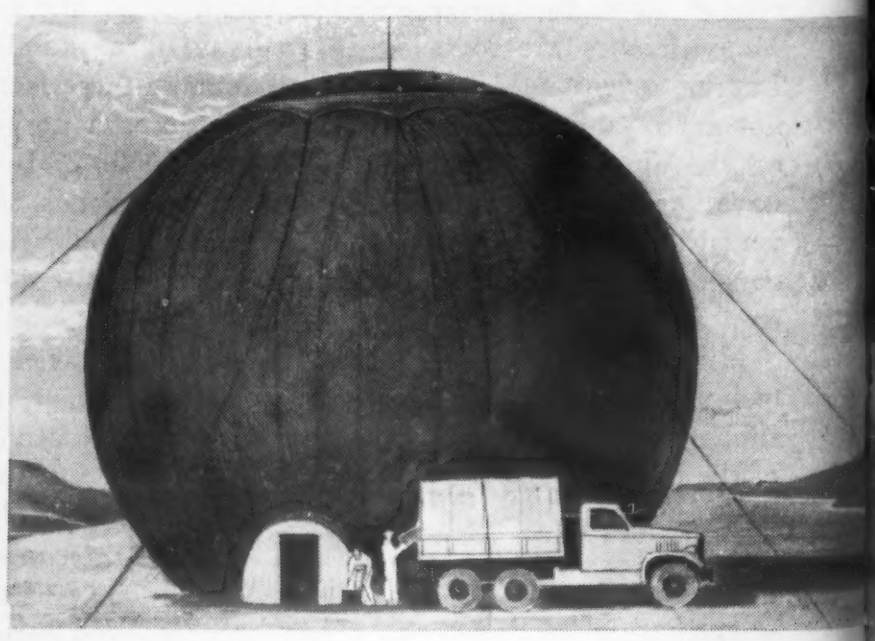

DEVELOPMENTS FOR THE AIR FORCE AND ARMY

Westinghouse was selected to develop the ground control mechanisms for the Boeing ground-to-air missile because of extensive experience in all the required fields. The system involved data gathering, transmission, display, evaluation and weapon assignment.

Westinghouse-developed "piggyback" radar solves the problem encountered in Korea where radar was either too far back to do any good or in danger of capture. By eliminating cumbersome equipment, the Westinghouse design permits portability never before attained.

UMI

Association Affairs

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Phone: EXecutive 3-3033

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**Executive Committee Member.*
†Executive Committee Member, non-voting.

SIGNAL STAFF ADDITIONS

Beginning with this issue of SIGNAL, new names appear on the masthead. Colonel Willet J. Baird, recently retired from the Army, has been named Editor by the AFCEA Executive Committee, to replace the late George P. Dixon.

Serving in the new position of Advisory Editor is Roland C. Davies, editor and publisher of *Telecommunications Reports*. The Executive Committee also appointed Colonel Burnett R. Olmsted, USA (Ret.), to be Business Manager of the Association.

Colonel Baird graduated from West Point, Class of 1926, and was commissioned in the Infantry. After numerous peacetime assignments in the Canal Zone, at Fort Benning, Georgia; Fort Sam Houston, Texas. and with the Washington Provisional Brigade in command and staff positions, Colonel Baird served as Chief of the Militarv Mission to the USSR and on the War Department General Staff from 1941 to 1943.

Administrative Background

Upon his graduation from the Command and General Staff School at Fort Leavenworth in 1943, he joined its faculty as Director of Instructor Training. Colonel Baird saw service in Korea as Regimental Commander of the 31st Infantry and later at the Headquarters of the U. S. Army, Pacific.

After studying at the Industrial College of the Armed Forces, Colonel Baird became Chief, Logistics and Materiel Planners on the Standing Group, NATO. In 1954 he returned to the Industrial College of the Armed Forces as Vice Deputy Commandant of the Education Division and in 1955 was appointed Assistant Commandant (Administration), in which capacity he served until his retirement. With his extensive background in military-industry relations, Colonel Baird's experience will be of great value to SIGNAL and the AFCEA.

Mr. Davies is well known to AFCEA members for his active support of Association activities over the past ten years. He was a national director from 1951 to 1955. As a prominent journalist in the communications field, Mr. Davies, serving without remuneration, is eminently qualified to advise the staff in matters in in this field.

A West Point graduate, Class of 1917, Colonel Olmsted retired from the Army in 1951. The last 31 of his 34 years of active duty were spent in the Ordnance Corps. He is a graduate of the Ordnance School of Technology, the Ordnance School of Application, Massachusetts Institute of Technology, Class of 1923, and has a Master's degree (MBA) from Harvard Graduate School of Business Administration.

His military duties have included: Assistant PMST—University of Wisconsin (1920); Ordnance Officer Tank School, Camp Meade, Md., (1923-1927); War Plans Requirement Division, Office, Chief of Ordnance, (1927-31); Ordnance Officer), 1st Corps Area, Boston, Mass., (1933-37); Chief of Engineering and Supply Divisions, Raritan Arsenal, N. J., (1937-39); Chief of War Plans and Requirements Division (later, Materiel Control Division). Office, Chief of Ordnance, (1939-45).

Other duties included: District Chief, New York Ordnance District, (1945-47); Special Assistant to the Chief of Ordnance for industrial mobilization affairs, and MDAP Chief of Production Service Division, (1949-51).

Signal Corps Summer Camp Award

The Association's annual award to the outstanding cadet of the Signal Corps ROTC Summer Camp at Fort Gordon was won this year by Ivan G. Eagleson of Northeastern University.

The gold medal and certificate were presented at the final camp ceremonies on August 3rd by Brig. Gen. Ralph T. Nelson, Commanding, Signal Corps Training Center, Fort Gordon, who is also honorary president of AFCEA's Augusta-Fort Gordon Chapter.

New AFCEA Chapter

Keflavik

Petition for charter for the Keflavik (Iceland) Chapter was approved by the Executive Committee in July. This increases to ten the number of AFCEA chapters outside the United States.

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Headed by Maj. George W. White, USAF, Iceland Defense Force, who directed the organizational efforts, the chapter has a charter membership of thirty-three representatives of the Air Force and industry.

The other chapter officers are: vice-presidents—Maj. John D. Lynch and M/Sgt. Quito J. Dinell, 1971 AACS; treasurer—Charles R. Houser, 1971 AACS; secretary—Paul E. Wagner, Page Communications Engineers, Inc.

Introducing AFCEA's New Group Members

Hogan Laboratories, Inc.

The AFCEA welcomed Hogan Laboratories, Inc., New York, N.Y. as a group member in June. Hogan Laboratories are researchers and developers in the field of graphic recording.

The following members of the firm have been designated to be company representatives in AFCEA: John V. L. Hogan, president; Raymond W. Bristol, executive vice-president; Elliott A. Crooks, vice-president; Jacob B. Burke, secretary and counsel; Magnus Johnson, treasurer; John W. Smith, chief engineer; John V. Hogan, assistant chief engineer; George M. Stamps, assistant chief engineer; Hugh C. Ressler, project engineer; David Shaler, project engineer.

Nems-Clarke, Inc.

Nems-Clarke, Inc., Silver Spring, Md., manufacturers of precision electronic instruments, became a group member of AFCEA in June.

The company representatives in the Association will be: A. S. Clarke, president; J. F. Whitehead, administrator of government contracts and director of sales; J. L. O'Gorman, chief production engineer; P. R. Mattix, assistant chief production engineer; K. B. Redding, sales department; R. E. Grimm, chief development engineer.

Companies Accepted for AFCEA Group Membership Since July 1, 1956

Nems-Clarke, Inc.
Hogan Laboratories, Inc.

Brief notes about these companies appear in this issue.

496 new AFCEA individual members from July 1 to Sept. 1

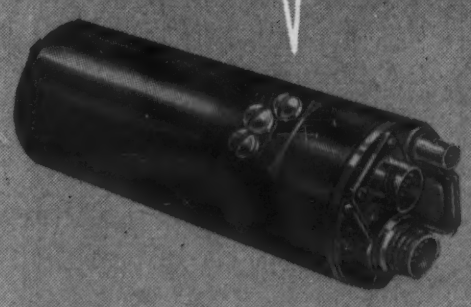
RADIO RECEPTOR

meets the challenge of the guided missile age

Now, as through the years, Radio Receptor, a leading contractor to the Armed Forces and Industry for almost 35 years, contributes heavily to America's conquest of the skies . . . by designing . . . and producing a wide range of radio aids to navigation for both piloted and unmanned aircraft.

To this field, Radio Receptor has introduced such developments as the AN/CRN-11 Air Transportable Radio Range; the first airborne and ground VHF equipment used by CAA; omnidirectional radio range systems in low and medium frequencies with associated airborne receivers . . . and the BC-446 transmitter which was the corner-stone of radio range navigation for AACS. The recent S-Band Missile Beacon illustrated and briefly described below is another example of the dynamic role Radio Receptor plays in the national defense.

One of RRco.'s latest projects is the design, development and manufacture of the subminiature S-Band Missile Beacon for the Army. This transistorized unit 6" long by 2½" in diameter provides communication facilities which permit tracking and guidance of the missile in flight.



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RADIO RECEPTOR COMPANY, INC.
In Radio and Electronics Since 1922
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RADAR, NAVIGATION AND COMMUNICATIONS EQUIPMENT, SELENIUM RECTIFIERS, GERMANIUM DIODES, THERMATRON DIELECTRIC HEATING EQUIPMENT.

1956 AFCEA-ROTC AWARDS

THE ASSOCIATION'S ANNUAL GOLD medal honor awards to the outstanding senior ROTC, AFROTC and NROTC students majoring in electrical engineering were presented to 197 young men at 122 colleges and universities this spring. In some cases, local chapters made awards to underclassmen.

The honor roll of these award winners is as follows:

A & M College of Texas
Leland C. White, *Army*
Robert W. Young, *Air Force*

A & T College of North Carolina
Andrew N. Handy, Jr., *Air Force*

Alabama Polytechnic Institute
Terry M. Eskew, *Army*
Robert B. Bliss, *Navy*

Brigham Young University
Don Parker, *Air Force*

California Institute of Technology
Paul O. Lindfors, *Air Force*

Carnegie Institute of Technology
George P. Lang, *Army*
Robert H. Detig, *Army* (jr.)
John W. Wesner, *Army* (soph.)

Case Institute of Technology
Robert W. Feucht, *Air Force*

Catholic University of America
Richard E. Higgins, *Air Force*

The Citadel
John T. Torlay, Jr., *Army*
Curtis A. Ritter, *Air Force*

The City College of New York
Alfred O. Stuff, *Army*

Clarkson College of Technology
Richard T. Ashcroft, *Army*

Clemson Agricultural College
Bobby J. Arnold, *Army*

Colorado A & M College
Gilbert L. Johnson, *Air Force*

Columbia University
Robert A. Weber, *Air Force*

Cornell University
Gerald F. Dulin, *Army*
Stephen G. W. Beck von Peccoz, *Air Force*
Herschel H. Loomis, Jr., *Navy*

Dartmouth College
Thomas E. Healy, *Navy*

Drexel Institute of Technology
Walter T. Greenwood, Jr., *Army*

George Washington University
James A. Cauffman, *Air Force*

Georgia Institute of Technology
Robert E. Sharpton, *Army*
John J. Pringle, III, *Air Force*
Philip J. Christensen, *Navy*

The Johns Hopkins University
Emil C. Muly, Jr., *Army*

Illinois Institute of Technology
Charles C. Rubey, *Air Force*
Walter I. Anderson, *Navy*

Iowa State College
Donald D. Carter, *Army*
Guntis Sraders, *Air Force*

Kansas State College
Albert A. Kaine, *Army*
Donald H. Lenhert, *Air Force*

Lafayette College
Thomas Burcak, *Army*

Lehigh University
Eugene R. Muntean, *Air Force*

Louisiana Polytechnic Institute
Karl K. Womack, *Air Force*

Louisiana State University
John S. Linder, *Army*
Philip R. Blanchard, *Air Force*

Loyola University of Los Angeles
Eugene P. Kessler, *Air Force*

Manhattan College
Donald B. Pennell, *Air Force*

Marquette University
Ronald W. O'Keefe, *Army*
John H. Farrow, *Navy*

Massachusetts Institute of Technology
Charles C. Joyce, Jr., *Army*
Ronald A. Massa, *Air Force*

Michigan College of Mining and Technology
Harry N. Yakabe, *Army*
Robert J. Hirvela, *Air Force*

Michigan State College
Donald R. Musson, *Army*

Michigan State University
Robert R. Murrel, *Air Force*

Mississippi State College
John W. Ramsay, *Air Force*

Montana State College
John E. Kimpton, *Army*
Clifford G. Jacobson, *Air Force*

New Mexico College of A & M
Robert C. Titsworth, *Army*

Newark College of Engineering
Charles W. Gruber, *Air Force*

The Citadel. Gen. Mark W. Clark, president, awards AFCEA medal to Air Force Cadet Curtis A. Ritter.

Utah State. Doyle W. Packer, AF, is awarded the medal by Dean Jerald E. Christiansen of the School of Engineering.

University of Minnesota. Prof. Henry E. Hartig, Electrical Engineering Department head, presents medal to Midshipman Robert M. Knox.

UMI

George Washington University. Dean Martin A. Mason, School of Engineering, congratulates Air Force Cadet James A. Cauffman.

University of Colorado. Air Force Cadet Jon R. Greene receives award from Dean W. H. Dyde, School of Engineering.

University of Kentucky. Prof. Edward E. Elsey, School of Engineering, presents medal to Air Force Cadet Walter F. Currie.

University of Missouri. Army Cadet Byron L. Craig is awarded the gold medal by Dr. Henry E. Bent, Dean of the Graduate Faculty.

University of Maryland. John E. Gilbarte, Washington Chapter president, presents award to Air Force Cadet Richard A. Smith.

Virginia Polytechnic Institute. Army Cadet McIvor L. Parker is presented the medal by Dean J. W. Whittemore, College of Engineering.

Columbia University. Air Force Cadet Robert A. Weber receives medal from RAdm William D. Irvin, Office of Chief of Naval Operations.

Lehigh University. Col. Earl J. Berryhill, Professor of Air Science, congratulates Air Force Cadet Eugene R. Muntean.

University of Idaho. Air Force George Eidam is presented award by Lt. Col. James M. Hughes, Professor of Air Science.

New York University
Army winner not reported
North Carolina State College of A & E
John C. Stuart, Jr., *Army*
Harry S. Reichard, *Air Force*
North Dakota Agricultural College
Jerome L. Vonderheide, *Army*
Lawrence L. Meyer, *Air Force*
Northeastern University
Raynor W. Taylor, *Army*
John S. Tuck, *Army* (jr.)
Paul Donato, *Army* (soph.)

Norwich University
Gilbert L. Theroux, *Army*
Ohio State University
Fred H. Irons, *Army*
Tom G. Purnhagen, *Air Force*
Ohio University
Philip A. Krock, *Army*
Oklahoma A & M College
Richard A. Rucker, *Army*
Orin K. Shellhammer, *Air Force*
Oregon State College
Ronald A. Shrock, *Army*

John C. Bowne, *Navy*
Pennsylvania Military College
Richard F. Aschettino, *Army*
Pennsylvania State University
Gustav H. Haak, Jr., *Air Force*
Grover W. Lang, *Navy*
Polytechnic Institute of Brooklyn
William L. Mohr, *Army*
Pratt Institute
Nicholas J. Reeber, *Army*
Princeton University
William F. Lange, Jr., *Air Force*

AFCEA-ROTC AWARDS

Robert Lugannani, *Navy*

Purdue University
Charles L. Snodgrass, *Army*
Robert P. Kotfila, *Air Force*
Neil J. Barta, *Navy*

Rensselaer Polytechnic Institute
Martin A. Karch, *Army*
Norman J. L. Violette, *Air Force*
David M. Orth, *Navy*

Rose Polytechnic Institute
Charles Schukai, *Army*

Rutgers University
Christian E. Smith, *Army*
Charles E. Molnar, *Air Force*

Seattle University
Martin J. Tapp, *Army*

South Dakota State College
Raymond C. Mayo, *Air Force*

Southern Methodist University
Samuel J. Davis, II, *Air Force*

Southwestern Louisiana Institute
William W. Hiter, *Air Force*

Stanford University
Kenneth S. Croker, *Army*
Warwick D. Musson, *Air Force*
Richard C. Anderson, *Navy*

State College of Washington
Peter W. Wood, *Army*

State University of Iowa
John O. Penhollow, *Army*

Syracuse University
James A. Kennedy, *Army*
Richard Healy, *Air Force*

Tennessee Polytechnic Institute
Robert B. Phillips, *Army*

Texas College of Arts & Industries
Russell D. Edgerton, *Army*

Texas Technological College
Richard G. Snyder, *Army*
James C. Wine, *Air Force*

Tufts College
Robert M. Schlesinger, *Air Force*
George H. Knightly, *Navy*

Tulane University of Louisiana
Bernard C. Frischhertz, Jr., *Navy*

Union College and University
John E. Drescher, *Air Force*

The University of Akron
John W. Lauby, *Air Force*

University of Alabama
George A. Bailey, Jr., *Army*

University of Alaska
Allen B. Hansen, *Army*

University of Arkansas
James E. Walker, III, *Army*
Benjamin E. Simpson, *Air Force*

University of Buffalo
Duane F. Hartman, *Air Force*

University of California (Berkeley)
Bennett S. Bibel, *Army*
Virgil L. Romiti, *Air Force*

University of California (L. A.)
Wing Jeung Wong, *Air Force*

University of Cincinnati
John W. Dettmer, *Air Force*

University of Colorado
Martin A. Errickson, *Army*
Jon R. Greene, *Air Force*
Paul H. Bardel, *Navy*

University of Connecticut
Reginald R. Burch, *Army*
George E. Harrington, *Air Force*

Marquette University. Army Cadet Ronald W. O'Keefe was awarded the gold medal during the Army ROTC annual Federal Inspection on May 15th. The presentation was made by John H. Paige, Vice President, Wisconsin Telephone Company, who is shown congratulating Cadet O'Keefe during the ceremony.

California Institute of Technology. Cadet Paul O. Lindfors was selected as the outstanding Air Force senior majoring in electrical engineering. At right, Dr. Gilbert D. McCann, Professor of Electrical Engineering, makes the presentation of AFCEA award to cadet Lindfors.

University of Delaware
Marshall H. Baker, *Army*

University of Denver
Edward R. Young, *Army*

University of Detroit
William J. O'Mara, *Army*
Karl H. Schumaker, *Air Force*

University of Florida
Charles E. Richards, *Army*
Floyd D. Kendrick, *Air Force*

University of Idaho
Russell A. Boor, *Army*
George F. Eidam, *Air Force*

University of Illinois
Bruno V. Dal Corobbo, *Army*
Robert P. Johannes, *Air Force*
Noel A. Grady, Jr., *Navy*

University of Kansas
Robert M. Crisler, *Navy*

University of Kentucky
James H. Stamper, Jr., *Army*
Walter F. Currie, *Air Force*

University of Louisville
James M. Boswell, *Navy*

University of Maryland
Richard A. Smith, *Air Force*

University of Massachusetts
Bernard S. Cudak, *Army*
Joseph P. Lambert, *Air Force*

University of Miami
Willard E. Lockwood, *Army*
Dennis W. Lenhart, *Air Force*

University of Michigan
Casimer J. Gogulski, *Army*
Horace W. Diamond, *Navy*

University of Minnesota
Russell McNaughton, *Army*
Robert M. Knox, *Navy*

University of Missouri
Byron L. Craig, *Army*
Roy L. Reed, Jr., *Air Force*

University of Nebraska
Wallis R. Cramond, *Air Force*

University of Nevada
Daniel S. Goodman, *Army*

University of New Mexico
Norman W. Petersen, *Navy*

University of North Dakota
Roger D. Brandt, *Air Force*

University of Notre Dame
Donald L. Gothard, *Army*
Walter J. Gill, *Air Force*
James L. Massey, *Navy*

University of Oklahoma
Richard E. Waddell, *Army*
Gene A. Cummings, *Air Force*
George A. Thomas, *Navy*

(*Continued on page* 86)

UMI

FERRITES—*a milestone in communications engineering!*

In today's communications engineering, ferrites are ranked with transistors in importance. Ferrites, modern cousins of the ancient lodestone, have more than doubled the efficiency of radar and microwave operations.

The ferrites are magnetic but, unlike natural ferromagnetic materials they resist electrical current. Replacing one of the iron oxide molecules in the lodestone formula with the oxide of any one of a number of metals results in a product which is similar in chemical and crystal structure to the lodestone but is resistant to electric current.

A few of the achievements for these strange new substances are:

1. *Simultaneous sending and receiving on a single microwave antenna.*
2. *Full-power transmission in microwave ranges with no power loss or interference.*
3. *Elimination of frequency drifts in microwave transmission.*

This new group of solid state materials makes possible the continuous search by radar, instead of the intermittent "pulse" sending and receiving of World War II. To fully understand all the implications and probable uses for ferrites, reserve your copy of this special October *Proceedings of the IRE* ferrites issue. It will take its place in the history of radio-electronics along with the transistor issue of November, 1952, and the solid-state electronic issue of December, 1955. You will want to read and refer to it for years to come!

SPECIAL OCTOBER ISSUE CONTAINS 27 IMPORTANT ARTICLES ON FERRITES:

"Resonance Loss Properties of Ferrites in the 9KMC Region" by S. Sensiper, Hughes Aircraft Co.

"Magnetic Resonance in Ferrites" by N. Bloembergen, Harvard Univ.

"Methods of Preparation and Crystal Chemistry of Ferrites" by Donald Fresh, Bureau of Mines

"Topics in Guided Wave Propagation in Magnetized Ferrites" by Morris L. Kales, Naval Research Lab.

"Frequency and Loss Characteristics of Microwave Ferrite Devices" by Benjamin Lax, Lincoln Lab., MIT

"The Non-Linear Behavior of Ferrites at High Microwave Signal Levels" by H. Suhl, Bell Telephone Laboratories

"Dielectric Properties and Conductivity in Ferrites" by L. G. Van Uitert, Bell Telephone Laboratories

"The Elements of Non-Reciprocal Microwave Devices" by C. L. Hogan, Harvard Univ.

"Fundamental Theory of Ferro- and Ferri-Magnetism" by J. H. Van Vleck, Harvard

"Ferrites as Microwave Circuit Elements" by G. S. Heller, MIT

"Radiation from Ferrite-Filled Apertures" by D. J. Angelakos, Univ. of Calif., Berkeley, Calif.

"Anisotropy of Cobalt-Substituted Mn Ferrite Single Crystals" by P. E. Tannenwald and M. H. Seavey, MIT

"Birefringence of Ferrites in Circular Waveguide" by N. Karayianis and J. C. Cacheris, Diamond Ordnance Fuze Labs., Washington, D. C.

"Ferrite-Tuned Resonant Cavities" by C. E. Fay, Bell Telephone Laboratories

"Ferrite Tunable Microwave Cavities and the Introduction of a New Reflectionless Tunable Microwave Filter" by Conrad E. Nelson, Hughes Aircraft Co.

"Permeability Tensor Values from Waveguide Measurements" by E. B. Mullen, G. E., Syracuse

"A New Ferrite Isolator" by B. N. Enander, RCA Labs.

"Ferrite Directional Couplers" by A. D. Berk and E. Strumwasser, Hughes Aircraft Co.

"Intrinsic Tensor Permeabilities on Ferrite Rods, Spheres, and Disks" by E. G. Spencer, L. A. Ault, R. C. LeCraw, Diamond Ordnance Fuze Labs., Washington, D. C.

"Magnetic Tuning of Resonant Cavities and Wideband Frequency Modulation of Klystrons" by G. Jones, J. C. Cacheris, C. Morrison, Diamond Ordnance Fuze Labs.

"Microwave Resonance Relations in Anisotropic Single Crystal Ferrites" by J. O. Ortman, Harvard Univ.

"Anomolous Propagation in Ferrite Loaded Waveguide" by H. Seidel, Bell Telephone Laboratories

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Northeastern University. Awards to the Northeastern University cadets were made by Maj. Gen. James D. O'Connell, Chief Signal Officer, at the AFCEA national convention in Boston. Shown above (left to right): Lt. Col. Eugene R. Patterson, Senior Signal Instructor, Northeastern; Col. Murray D. Harris, Professor of Military Science and Tactics, Northeastern; General O'Connell; Prof. Martin W. Essigman, Chairman and Co-ordinator of Electronics Research, Northeastern; Frederick T. Hershey, winner of USVSCA medal; Raynor W. Taylor, AFCEA gold medal; John S. Tuck, AFCEA silver medal; Paul Donato, AFCEA bronze medal.

University of Akron. John W. Lauby won the award as the outstanding Air Force senior majoring in electrical engineering. Above, Dean R. D. Landon of the College of Engineering congratulates Cadet Lauby following the presentation ceremony.

AFCEA-ROTC AWARDS

Napoleon L. Morris, *Navy*

University of Southern California
Allan R. Thompson, *Navy*

University of Texas
Allen E. Fogelberg, *Air Force*
Robert F. Gribble, *Navy*

University of Toledo
Donald J. Pauken, *Army*

University of Utah
Norman E. Packer, *Air Force*
Dean A. Chambers, *Navy*

University of Virginia
Russell I. Townsend, Jr., *Army*
Henry E. Harris, *Navy*

University of Washington
Arthur H. Dietz, *Air Force*
Leslie K. Y. Hong, *Navy*

University of Wisconsin
Frederick A. Luhman, *Army*
Kenneth E. Niebuhr, *Air Force*

University of Wyoming
Charles L. Pfeifer, *Air Force*

Utah State Agricultural College
William G. Smith, *Army*
Doyle W. Packer, *Air Force*

Vanderbilt University
Charles W. Lewis, *Army*

Villanova University
John L. Chabay, *Navy*

Virginia Military Institute
Charles C. Schoen, III, *Army*
Lawrence F. Frase, *Air Force*

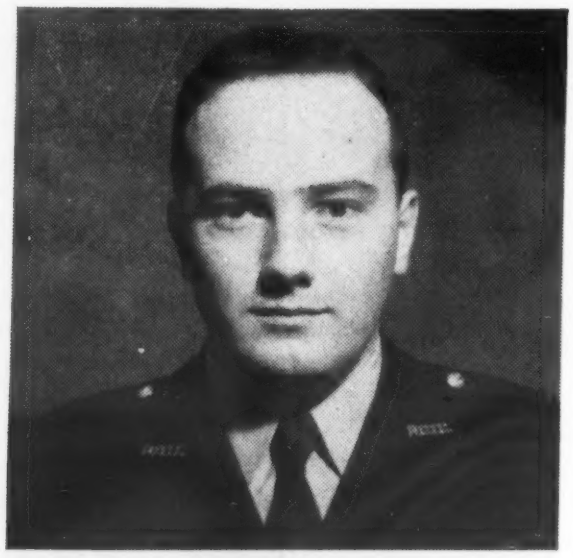
Virginia Polytechnic Institute
McIvor L. Parker, *Army*
Clifton H. Tucker, *Air Force*

Washington University
Ernest P. Kieckers, *Army*
Harold A. Tegthof, *Air Force*

West Virginia University
Gerald L. Showalter, *Army*
Glen H. Hiner, Jr., *Air Force*

Gene A. Cummings, AF
University of Oklahoma

Robert M. Schlesinger, AF
Tufts College



William J. O'Mara, Army
University of Detroit

University of Pennsylvania
Jack K. Wolf, *Air Force*
John H. MacLaren, *Navy*

University of Pittsburgh
Lawrence P. McNamee, *Army*
Henry J. Zentgraf, *Air Force*

University of Rhode Island
Harold E. Brown, *Army*

University of South Carolina
Billy C. Catoe, *Air Force*

Worcester Polytechnic Institute
Paul D. Schoonmaker, *Army*

Youngstown University
Bernard J. Vojtko, *Army*

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Tower HORIZON Stretcher
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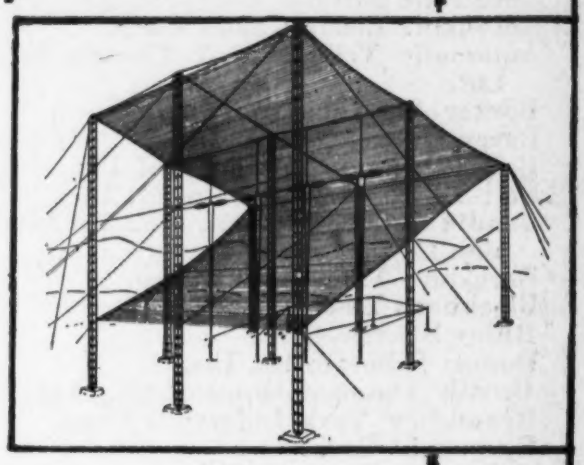

It was for Gerhard Mercator, history says, to solve some mighty knotty 16th century navigational problems by accurately projecting the earth's curved surface onto a flat plane. Adventurous navigators needed more than crude maps to safely venture beyond their horizons. From the pen of this Flemish mapmaker came the "projection" method of chartmaking. On Mercator's drawing board is found the birthplace for the reliable maps and charts of modern navigation.

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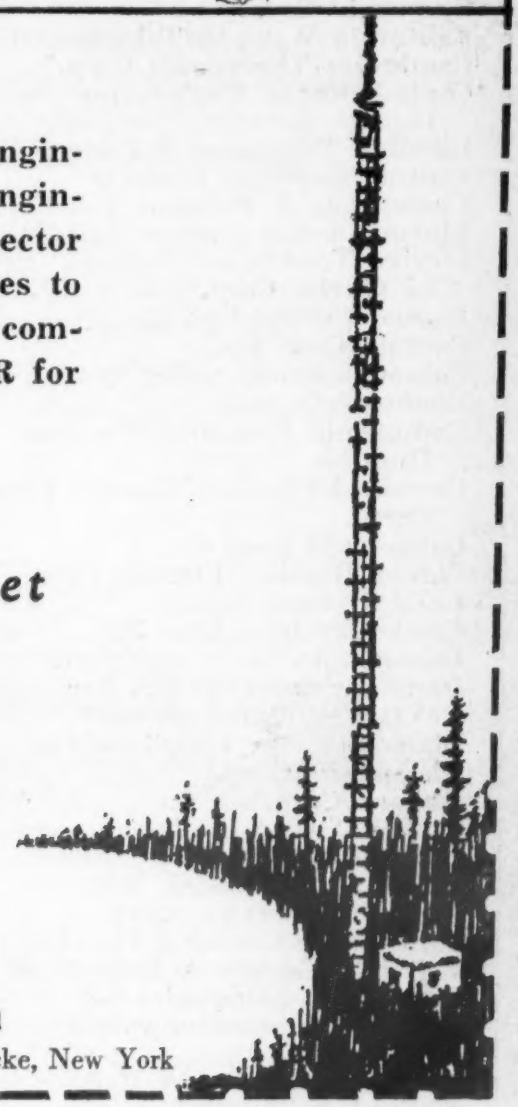

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DuMont, Allen B., Laboratories, Inc.
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Haloid Co.
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Reeves Instrument Corp.
Remington Rand, Division of Sperry Rand Corp.
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Saxonburg Ceramics
Sigma Instruments, Inc.
Society of Motion Picture & Television Engineers
Sonotone Corp.
Soundscriber Corp.
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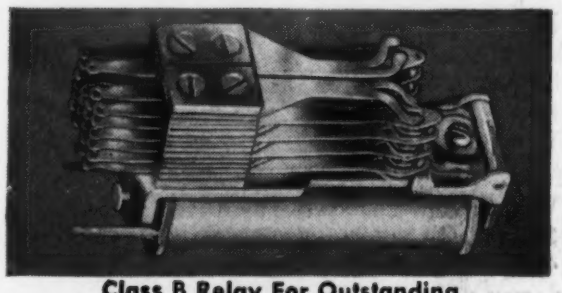

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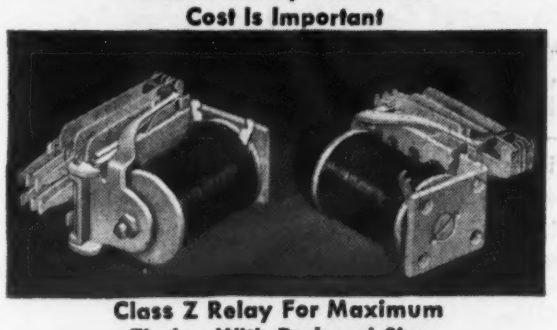

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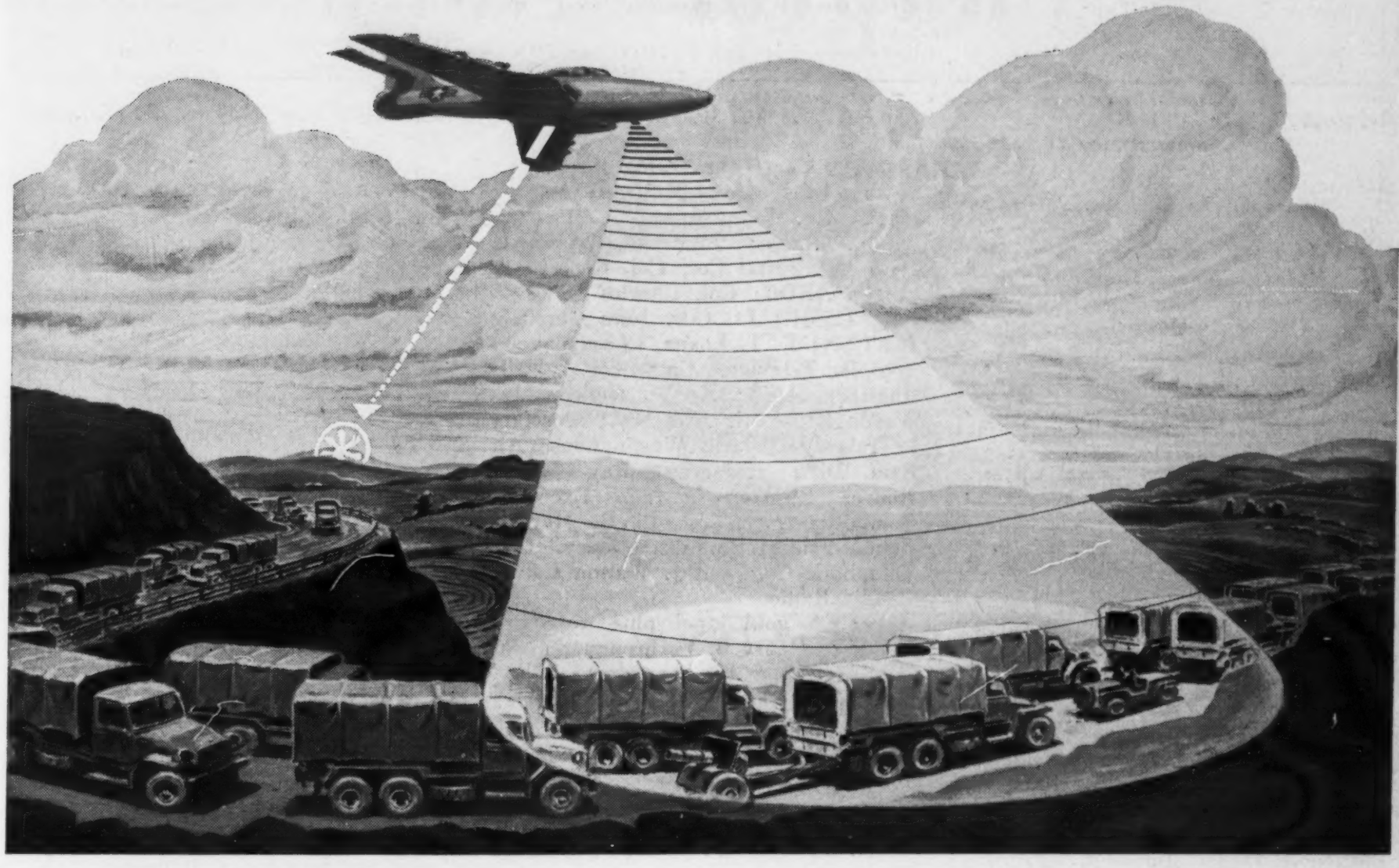

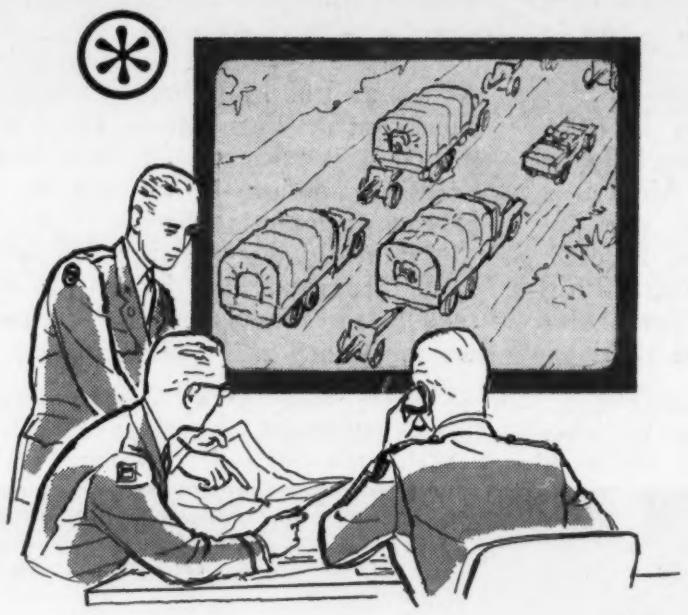

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Chapter News

Arizona

Chartered May 26, 1955

Atlanta

Chartered February 18, 1948

Augusta-Fort Gordon

Chartered April 19, 1949

Guest speaker at the June 14th meeting was Col. W. D. Harden, Commodore of the Augusta Sailing Club and former president of the Augusta Historical Society. With sailing as his subject, Colonel Harden discussed the different types of sail boats, sailing terms and their applications. He illustrated his presentation with a series of color photo slides taken of the sailing club members and their crews sailing their boats at Clarks Hill Lake.

The July 19th meeting was a steak dinner party and dance at Timmermans in Augusta to honor the wives of the chapter members. The door prize was a set of steak knives and was won by Mrs. Percy C. Reardon.

Arrangements for this successful social event were made by the following program committee: Col. B. L. Avera, chairman; T. M. Baker, and Maj. C. Picciouolo.

Baltimore

Chartered May 6, 1947

The United States Naval Academy was host to the chapter on June 16th. Activities included a luncheon meeting, social hour, and a tour of the Naval Radio Station or a cruise around Chesapeake Bay in a yard patrol boat.

The results of the recent annual election were announced as follows: president — George C. Ruehl, Jr., who had headed the chapter during 1952-54; vice-presidents — Lt. Cdr. Joseph G. Bastow, USCG; John M. Pearce, Hoover Electronics, Inc.; Adam A. Fiedler, Bendix Radio; John W. Downing, Downing Crystal Co.; Col. Richard S. Carter, ARDC; Col. Charles L. Cogswell, USMC; Lt. Cdr. John Gersouk, Jr., USN; E. T. Loane, Chesapeake & Potomac Telephone Co.; Lt. Col. E. T. Rhatigan, USA; F. W. Godsey, Jr., Westinghouse Air Arm Div.; secretary —Trevor H. Clark, Westinghouse Air Arm Div.; treasurer — Ray Moore, Hoover Electronics, Inc. Executive Committee members: E. R. Harrall, Bendix-Friez; Plummer Wiley, C&P Telephone Co.; and J. Walton Colvin, Bendix Radio.

AFCEA gold lapel pins were presented to Henry B. Yarbrough, retiring president, and to Lt. Cdr. John M. Jones, electronics officer, Naval Radio Station, Annapolis, in token of the chapter's gratitude for their outstanding service.

Boston

Chartered November 14, 1947

Cayuga

Chartered April 7, 1954

Central Florida

Chartered February 1, 1956

The July 12th meeting was held at the Officers' Club, MacDill Air Force Base. A program committee was appointed for six months as follows: chairman—Kenneth E. Schubert, Philco Corp.; Arthur M. Brown, Peninsular Telephone Co.; Capt. Harold E. Logsdon, USAF; and Richard W. Schneider, Electrical Instruments Co.

At the conclusion of the business session, the members drove to the site of the 660th Air Control and Warning Squadron where radar search sets and height - finding and communications equipment were explained and demonstrated.

Chicago

Chartered October 5, 1946

Capt. Leland P. Kimball, Jr., Supply Corps, USN, Commanding Officer, and personnel of the Electronic Supply Office, Great Lakes, were hosts to the chapter for its monthly dinner meeting and annual election on June 7th. One hundred and forty members and guests were present.

Featured speaker was Capt. W. I. Bull, USN, Asst. Chief (Electronics), Bureau of Ships, who talked to the group on how the Electronic Supply Office ties in with the electronics program of the Bureau of Ships, and the significance of that program to industry.

Captain Bull reviewed the incidents which led to the establishment of the Electronic Supply Office and stated that the Bureau of Ships would have found it difficult to handle the post-war problems of electronic supply if inventory control and purchase functions had been kept in Washington. He said that the Navy is taking on a "new look," a necessary action if we are to keep abreast of potential threats.

"Naturally, our research and development programs are being pushed to seek better counters to the threats that we must face . . ." said Captain Bull.

Shown at the Baltimore Chapter meeting on May 16, 1956, at U. S. Coast Guard Yard (left to right): Mrs. J. A. Shipley; Adam A. Fiedler; Mrs. Adam A. Fielder; Col. George V. Johnson, USA; Mrs. George V. Johnson; George C. Ruehl, Jr.; Capt. Hicks, Commandant, USCG Yard; Mrs. Joseph G. Bastow; Lt. Cdr. Joseph G. Bastow, USCG; Mrs. J. Walton Colvin, and J. Walton Colvin

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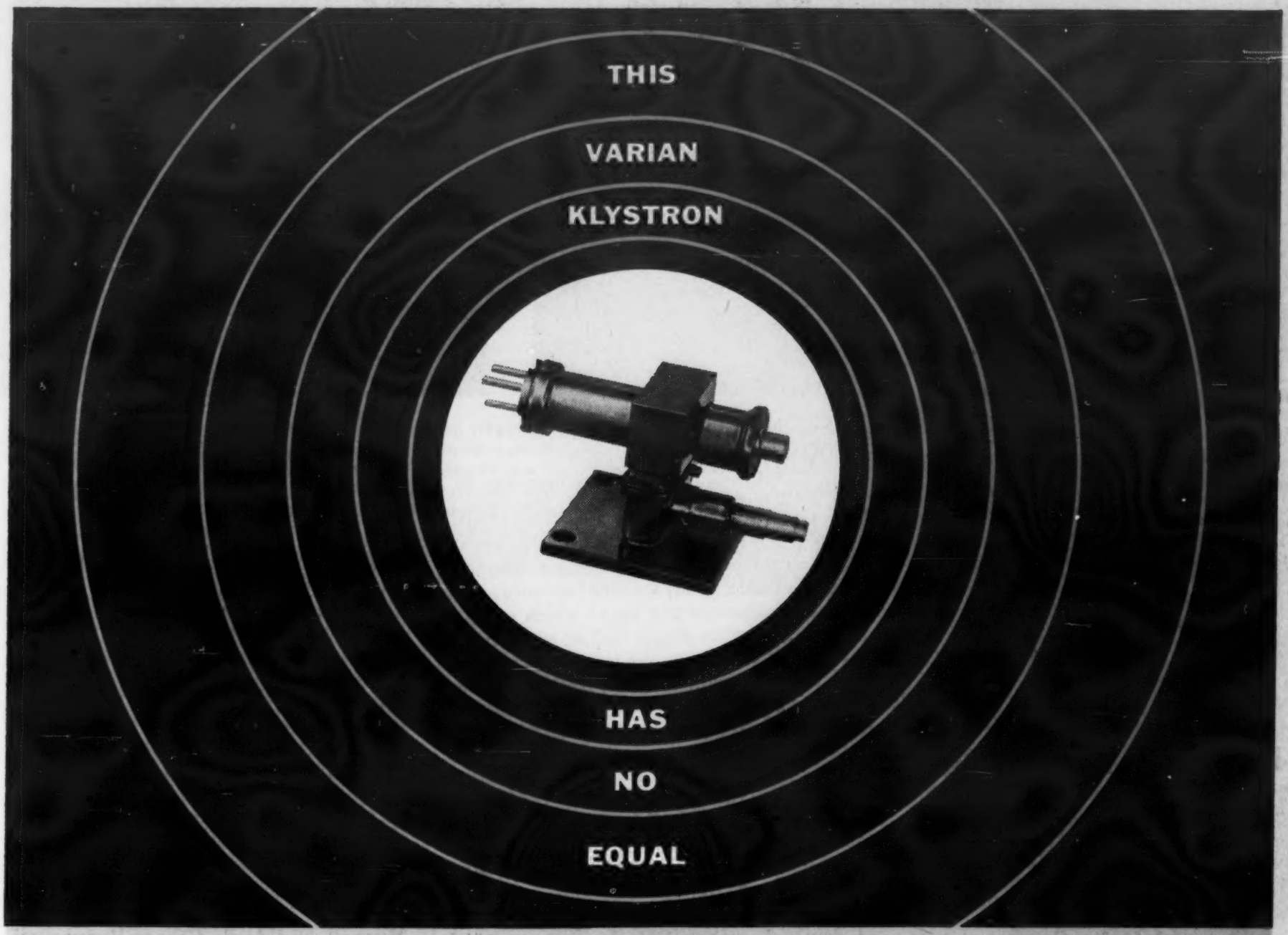

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Power Output	20mW, Min	40mW, Min
Electronic Tuning Range	30 Mc, Min	20 Mc, Min
Vibration FM at 10 G	1 Mc, p-p, Max	0.2 Mc, p-p, Max

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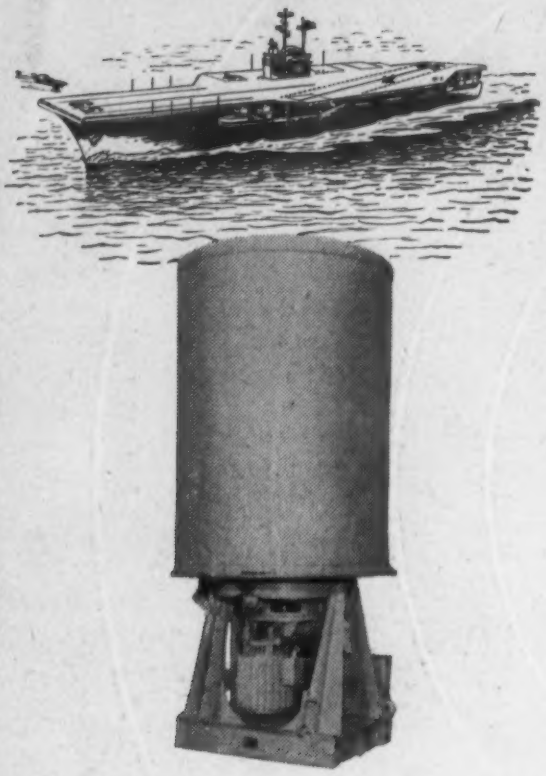

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Newly-elected officers of Chicago chapter present at the monthly dinner meeting July 12. Hosts were Capt. Kimball and personnel of Great Lakes Electronic Supply Office. Left to right: James F. Weldon, secretary-treasurer; Col. A. N. Niemi, Signal Corps, director; Raymond K. Fried, president; John R. Howland, director; D. B. Miller, vice president; Capt. L. P. Kimball, Jr., USN, director; Carrington H. Stone, vice president.

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Officers elected or re-elected for 1956-57 were as follows: president — Raymond K. Fried, attorney; vice-presidents—Carrington H. Stone, consulting engineer; Henry J. McDonald, Kellogg Switchboard & Supply Co.; D. B. Miller, Coyne Electric & TV School; secretary-treasurer—James F. Weldon, Army Signal Supply Agency.

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Dayton-Wright

Chartered January 20, 1948

The chapter's annual meeting on June 27th concluded the current year's activity with the election of new officers. A cocktail party and buffet dinner preceded the business of the evening.

The following slate of officers was chosen for the coming year: president—Byron K. Boettcher, AVCO Manufacturing Corp.; vice-presidents — F. R. Demchock, Air Materiel Command; W. M. Hilt, General Mills, Inc.; John Wilkinson, Amphenol Corp.; Ralph A. Root, Jr., RCA; Col. L. J. Israel, Wright-Patterson Air Force Base; secretary-treasurer—M. S. Gazella, AVCO Manufacturing Corp.

Elected to the board of directors: Brig. Gen. T. L. Bryan, Jr., Maj. Gen. M. D. Burnside, Brig. Gen. H. M. Estes, Jr., and Brig. Gen. V. R. Haugen, all of Wright-Patterson Air Force Base; John E. Keto, Wright Air Development Center; John W. Kinnally, Philco Corp.; William Klein, Gruen Watch Co.; Col. C. H. Lewis, W-PAFB; Edward M. Lisowski, Philco Corp.: A. S. Lord, Air Materiel Command; Brig. Gen. C. H. Mitchell, W-PAFB; George Rappaport, Wright Air Development Center; Willis K. Sutton, Summers Gyroscope Co.

Decatur

Chartered November 19, 1946

At its June 28th meeting, the chapter decided to introduce a technical training program in electronics and photography for the balance of the calendar year. The courses will be self-sustaining and will be open to chapter members and their families.

Tentative plans call for the following courses of training: Photography (40 hours—one night a week), which will include: (a) fundamentals of theory, history and processing; (b) application of photography in movies, pictorialism as a hobby and vocation, etc.; (c) color theory and pictorialism. Electronics (312 hours—3 hours one night a week), which will include (a) AC, DC and vacuum tubes; (b) power supplies, amplifiers, receivers and transmitters; (c) television and/or carrier.

If there are sufficient enrollees, the courses will commence in September and will be scheduled on dates other than those of regular chapter meetings.

The objective of the training program is to stimulate active interest in chapter activities and increase membership. At an earlier meeting, additional recommendations for creating interest called

for demonstrations of military field type communication systems for amateurs and for Signal Corps equipment demonstrations before local service clubs.

Detroit

Chartered June 22, 1949

Fort Monmouth

Chartered August 12, 1946

Kenneth B. Clarke, Defense Projects Division of Western Electric Co. and Superintendent of Technical Coordination, Dew Line Project, was guest speaker at the chapter's closing meeting of the 1955-56 season.

In his talk, which was illustrated by slides and film, Mr. Clarke described the problems encountered in surveying, supplying, and constructing the Dew Line across Northern Alaska and Canada. He also discussed the problems of the numerous contractors engaged in handling logistics connected with this project and the tremendous obstacles of terrain and weather which had to be overcome.

Gulf Coast

Chartered March 8, 1951

At the July 2nd meeting a report was presented to the membership on the progress of the committee on student activities. The current plans were outlined as follows:

(1) In October, high school students from the 10th, 11th and 12th grades of the Biloxi and Gulfport High Schools will be invited to participate in a guided tour of Keesler Air Force Base. The itinerary will include pickup by Air Force buses, tour of the Basic Electronic Department and Ground Electronic Department, review of the troops at the noon change of classes, and return to school.

(2) In November, the same students will be invited to tour the Bell Telephone plant. The Gulfport students will tour the Gulfport plant and the Biloxi students will tour the Biloxi plant.

(3) In February, the chapter will present one assembly program at the Gulfport and Biloxi High Schools.

Capt. A. C. Wizeman was appointed to the chairmanship of the program committee and Ancil Z. Arseneau was appointed chapter representative on the National Council.

Hawaii

Chartered March 20, 1953

Kansas City

Charterd February 7, 1952

Korean

Chartered January 1, 1956

Lexington

Chartered as Kentucky Chapter July 16, 1947

Re-chartered as Lexington Chapter August 10, 1956

The former Kentucky Chapter, after several years of inactivity, returned to

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its place on the active roster after a reorganization meeting on June 8th. The reactivation was initiated by Col. Sterling C. Bush, Commander, Lexington Signal Depot, with the assistance of Lt. Col. Randolph H. Vinding, Deputy Commander, who until his transfer to the Depot in June had been president of AFCEA's North Texas Chapter.

Chapter officers were elected on June 8th as follows: president—Roger L. Lyons, General Telephone Co., who has since been transferred to the home office of his company in Fort Wayne, Ind., as general plant manager; vice-president — Maj. K. J. Holmes, Lexington Signal Depot, who succeeded to the presidency; secretary—Michael E. Keller, Lexington Electronics Co.; treasurer — Merrell L. Whitmer, Lexington Signal Depot.

Official recognition of the chapter's return to active status was given by National President Percy G. Black at a chapter banquet on August 10th at the Campbell House in Lexington. In his address to the chapter, President Black congratulated it on its renewed interest in the Association and on its successful reorganization. He reported on national affairs of the Association and reviewed current plans for increased activity both on the national and chapter levels.

Presentation of a new charter, renaming the chapter as the Lexington Chapter, was made to Major Holmes, chapter president, by Colonel Black. Present as a representative of Maj. Gen. James D. O'Connell, Chief Signal Officer of the Army, was Col. Charles F. Fell, who brought a message from General O'Connell congratulating the chapter on its renewed activity.

London
Chartered February 4, 1954

Louisiana
Chartered January 3, 1949

Montgomery
Chartered February 7, 1955

Pictured during an informal get-together before the charter meeting of the Lexington Chapter are, left to right: Col. Charles F. Fell, Assistant Chief, Procurement and Distribution Division, Office of the Chief Signal Officer; Col. Percy G. Black, AFCEA National President; Lt. Col. Randolph H. Vinding, Deputy Commander, Lexington Signal Depot, and president of the Fort Worth chapter until his transfer to Lexington; Major K. C. Holmes, chapter president, and Michael E. Keller, chapter secretary.

Nagoya
Chartered May 4, 1956

New York
Chartered July 1, 1946

Members of the New York Chapter, their ladies and guests, held their traditional (and traditionally successful) annual picnic on Governors Island on June 20th.

The chapter reports the weather was good, although a bit blustery, and that everyone enjoyed the outdoor-cooked meal. Music was also provided for dancing.

Arrangements for the outing were made by Col. C. "Brundy" Brown, First Army Signal Officer.

North Carolina
Chartered December 16, 1955

North Texas
Chartered as Dallas Chapter January 1, 1948

Re-chartered as North Texas Chapter April 1, 1954

Station WBAP-TV, Fort Worth, was the scene of the chapter's June 29th meeting.

A catered barbecue dinner was followed by a complete tour of the facilities of the AM, FM and TV studios, broadcast booths, control panels, etc. The tour included a trip to the transmitter site and a detailed description of both the radio and television transmitters given by the chief engineer.

After the tour, members returned to the studios and observed three "live" telecasts.

During the business session, H. J. Wissemann, former vice-president, was officially installed as president of the chapter to succeed Lt. Col. R. H. Vinding, who had been transferred to Kentucky.

Northwest Florida
Chartered January 13, 1955

Orange
Chartered April 6, 1956

Although chartered in April, the official presentation of the chapter charter was made on June 21st by National President Percy G. Black. In presenting the charter to chapter president Fred Cullman, Colonel Black congratulated the chapter on its enthusiasm and sound organization. He then reviewed the aims and objectives of the AFCEA and reported on recent activities of the Association.

Attending the meeting of the Fort Monmouth chapter at Gibbs Hall, May 17, were, (left to right): Col. John C. Monahan, Fort Monmouth Chief of Staff; Kenneth B. Clarke of Western Electric Co. who was guest speaker; Col. Fred J. Elser, chapter president; Mrs. John W. Wopat, and Col. Joseph Heinrich.

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CHAPTER NEWS

Also present was Ralph Grist, regional vice president, who elaborated on the highlights of the annual convention in Boston in May, and Col. Forrest Donkin, Deputy Commander, Airways and Air Communications Service, who also congratulated the chapter on its organization.

During the business portion of the evening, the chapter adopted a program aimed at stimulating interest in engineering among high school students in the local area. Major Donald E. Dobbins, chapter secretary, was appointed chairman of a special committee to carry out this program, with George Fenton, L. A. Brown and Grattan Hammond as committee members.

Generally, the program calls for a team of speakers from the local communications-electronics industry (preferably one military and two civilian members) with a kit of informational material such as charts, graphs and films, to tour the Central Florida area visiting the various high schools. Concurrence of the various county supervisors of education will be obtained, as well as that of the high school principals.

Other committee appointments were made as follows: program — Lewis Brown of Southern Bell Telephone Co., chairman; membership—Eugene Johnson of Johnson Electronics, chairman.

Paris

Chartered November 12, 1952

Philadelphia

Chartered November 15, 1946

Recent annual elections resulted in the following new officers for the chapter:

President — William F. Powell, Jr., Bell Telephone Co.; vice-presidents—Richard Wickes, Wickes Engineering & Construction Co.; James D. McLean, Philco Corp.; David Bagenstose, International Resistance Co.; Brig. Gen. William D. Hamlin, USA; Col. W. J. Adams, USAF; Capt. H. W. Englund, USN; secretary—Robert G. Swift, Diamond State Telephone Co.; treasurer—Thomas H. Armstrong, Radio Condenser Co.

Philippine

Chartered May 10, 1955

A meeting of the chapter was held on May 24th in the Malayan Room of the Clark Air Base Officers Club. After a get-acquainted period over cocktails and dinner, the business session was opened with the welcoming of fourteen new members.

The annual election of officers was held with the following results: president—Maj. Ted E. Reger, Director of Communications - Electronics, SAMAP; vice-presidents—Capt. R. J. Woodaman, COMNAV PHILCOM; Maj. Harvey S. Powell, 6207th AC&W Sqdn; secretary

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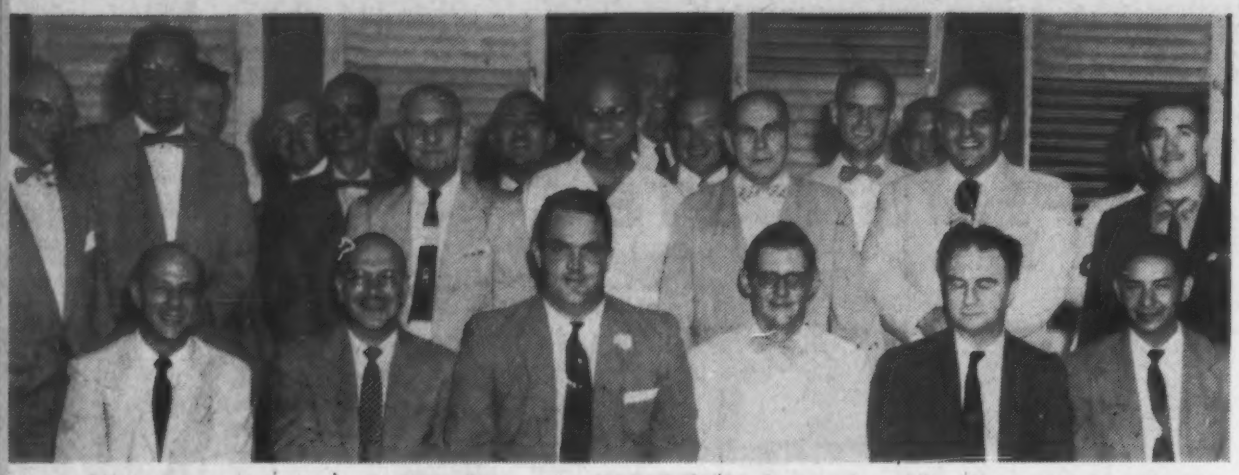


Midsummer meeting of San Juan Chapter. Seated (l to r): Felix Gros, CAA, director; Thomas Ramirez, Antilles Signal, director; James Fitzwilliam, Antilles Signal, president; Kinne Prachel, TV, vice president; Jose Dominguez, P. R. Tel. Co., director; Jose Pabon, Commonwealth Police, treasurer. Standing (l to r): Mr. Compton, P. R. Tel. Co.; Wyman Borden, P. R. Tel. Co.; Lt. Col. Leo Kane, Antilles Signal Officer; Jorge Toledo, Radio Corp. P. R.; Lowell Boyd, Caribbean Atlantic Airlines; Arthur Cline, Jr., FCC; Herbert Rooney, Photo Mart; Lt. Eugene Finke, USN COMMSTA; Philip Streit, P. R. Tel. Co.; Thomas Collins, USN COMMSTA; William Lacomba, TV Concern.

—Capt. Frank S. Covey, SAMAP; treasurer — Maj. Stanley E. Wozniak, 1961st AACS Sqdn.

Program feature of the meeting was a lecture on "TV Kinks" by David F. McGuire of the 14th Communications Squadrons, USAF.

Pittsburgh

Chartered October 14, 1947

Two hundred and sixty-one members and guests were treated to an all-inclusive tour of the Pennsylvania Railroad's Conway Freight Classification Yard recently. A private train, the "AFCEA Special," left Pittsburgh at 1:30 P.M. A scenic trip along the Ohio River took the chapter to Conway, 25 miles west of Pittsburgh. Upon arrival at Conway, the group was broken down into units of about 25 members each under the supervision and guidance of a Pennsylvania Railroad guide.

A most informative tour followed of the maintenance shops and an emergency work train, control tower and relay center. The members were amazed at the automatic manner in which by merely pressing a button, strings of cars were broken down, directed to one of the 57 classification tracks, weighed and speed controlled—all electronically.

At the completion of the tour, those interested inspected a yard and road Diesel and then boarded the "AFCEA Special" for the return trip.

Chapter President A. M. Crawford, Pennsylvania Railroad Co., made the arrangements for this outstanding program.

On June 5th, the chapter met at the new Holiday House at Monroeville for its annual dinner-meeting. The new officers who had been elected by mail ballot were installed as follows:

President—Harold W. Mitchell, Bell Telephone Co.; vice-presidents—G. E. Aderhold, Saxonburg Ceramic & Manufacturing Co.; Maj. John T. Dabinett, Carnegie Tech; W. W. Ege, Copperweld Steel Co.; J. J. Seitz, Union Switch & Signal; H. Lundberg, Shields Rubber Co.; H. S. Brown, Mine Safety Appliance Co.; L. A. Shew, Western Union; secretary — Harry W. Shepard, Jr., Stanwix Autoparks & Garages; treasurer—W. H. Yates, Western Union.

Directors are: F. E. Leib, Copperweld Steel; E. J. Staubitz, consulting engineer; S. C. Stoehr, Bell Telephone Co.; Ralph W. Will, Hamburg Bros.; S. E. Phillips, Bell Telephone Co.; David W. Bushmire, Carnegie Tech; E. W. Breisch, Union Switch & Signal. Member Executive Committee—A. M. Crawford, retiring president.

Rocky Mountain

Chartered April 25, 1955

Rome (Italy)

Chartered March 23, 1955

During June, the chapter scheduled a series of lectures on "Transistors and Their Application" by Professor Renato Manfrino, Chief, Transistor Application Laboratory, Instituto della Poste e Telecommunicazione. The lectures, sponsored by Contraves Italiana, associate group member of the AFCEA, were of a technical nature and were presented in Italian.

The program of lectures was as follows: June 5th—"Semiconductors and mechanics of Semiconduction"; June 7—"Physics of Transistors"; June 12—"Description of Various Types of Transistors and their Operation"; June 14—"Transistors Compared to Vacuum Tubes."

Rome-Utica

Chartered November 23, 1955

Sacramento

Chartered November 20, 1946

San Francisco

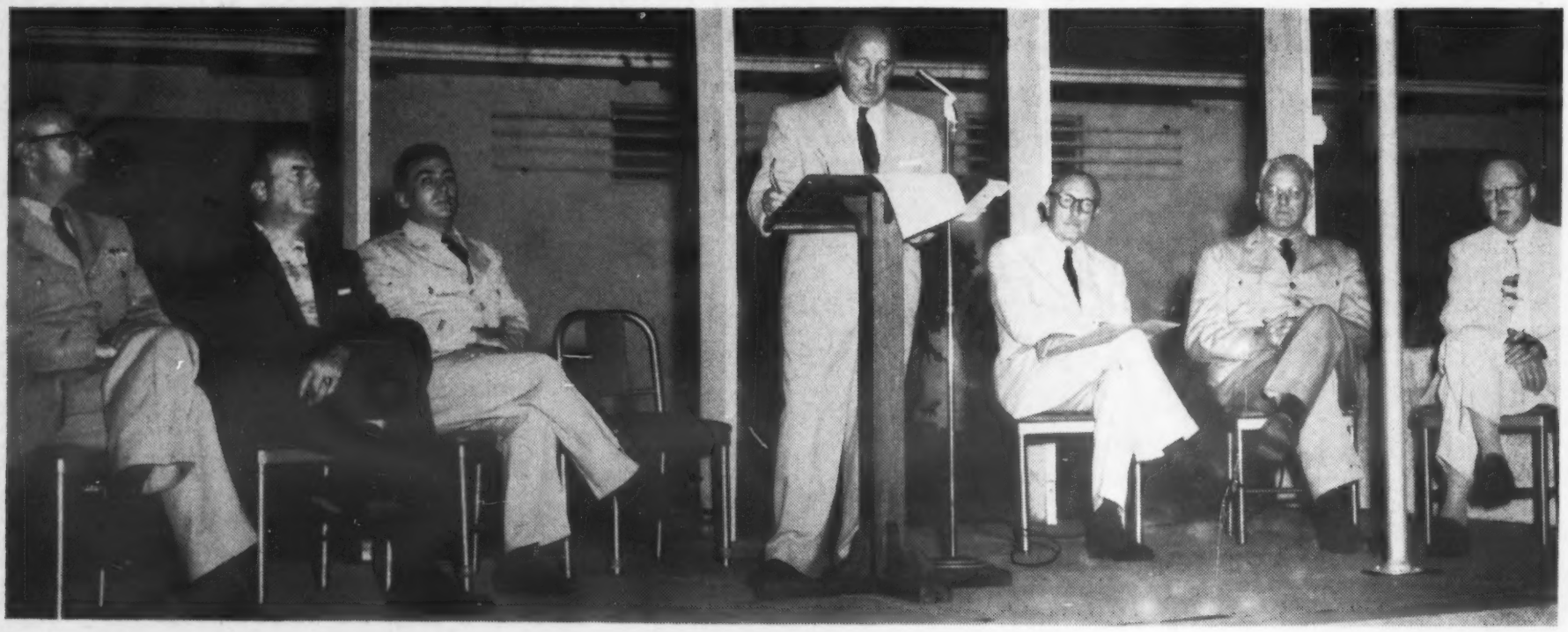
Chartered March 11, 1948

On July 19th, the Western Electric Co. opened the doors of its new distributing house at San Leandro to some ninety members and guests of the San Francisco Chapter.

Telephone, radio and teletype equipment removed from service is sent to the distributing house for test and repair or salvage. The plant serves the Pacific Telephone and Telegraph Co. in northern California and Nevada.

The distribution and warehousing section was an interesting feature. The setup for filling requisitions from the

Charter presentation at Orange Chapter June 21st. Left to right: Col. F. R. Delaney, Cmdr., 1816th AACS Group; J. S. Cooper, Southern Bell Tel. Co.; Maj. D. E. Dobbins, secretary, Orange Chapter; Fred Cullman, president, Orange Chapter; Col. Percy Black, president, AFCEA; Col. Forrest Donkin, Dep. Cmdr., AACS; Ralph Grist, Reg. Dir., AFCEA.



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Official U. S. Navy Photograph

The U. S. S. Boston (CAG-1), the Navy's first guided missile cruiser, with Terrier Missiles and their launchers at the stern.

NAVY BUREAU OF ORDNANCE DEVELOPS WEAPON SYSTEMS FOR USE AGAINST ATTACK BY SEA OR AIR

The recent unveiling of the Navy's first ready-for-combat anti-aircraft guided missile weapon system —TERRIER—is but one result of the research and development work being done by the U. S. Navy's Bureau of Ordnance and a coordinated team of industrial and educational institutions.

From its establishment in 1842, the Bureau of Ordnance has provided the weapons with which the Navy has fought victoriously in six wars. With the evolution of armament, from the first muzzle loading cannons to today's complex weapons systems, it has directed the design, development, and production of the computers, fire control, and other types of equipment comprising the Navy's air, surface, and underwater ordnance.

The Research and Development Division of the Bureau of Ordnance has the responsibility of initiating and coordinating the research and development of the many projects which result in such end products as guided missiles, homing torpedoes, aircraft laid mines, and the launching and control systems for these weapons.

The job of guiding a key element of a modern day weapon system from the idea stage to the ready-for-combat stage involves a wealth of technology—drawing upon the skill, farsightedness, and courage of responsible scientific and technical personnel in the Bureau of Ordnance and its laboratories, and their counterparts in universities and industrial organizations.

This is one of a series of ads on the technical activities of the Department of Defense. 103

FORD INSTRUMENT COMPANY
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Ford Instrument Company engineer placing equipment designed for Navy instrument in one of the environmental test chambers.

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RADIO CORPORATION OF AMERICA

Present and past presidents of the Washington Chapter are pictured at a cocktail party on June 13th in honor of the retiring and new officers and directors of the chapter. Left to right: Millard C. Richmond, 1956-57 president, who was host; John F. Gilbarte, 1955-56; Col. Frank W. Wozencraft, 1954-55; Thomas B. Jacocks, 1953-54; Rear Adm. Joseph R. Redman, 1952-53; Col. Percy G. Black, 1951-52; Francis H. Engle, 1949-1951.

many exchange centers is mechanized wherever possible. Overhead drag lines are used to move warehouse trucks in a continuous chain from bins to the packing and loading docks. Thousands of large and small items from paper clips and number plates to reels of cable and P.B.X.'s are stocked and shipped from here.

At the conclusion of the tour, the AFCEA group saw a movie entitled "Tools of Telephony," which highlights in color Western Electric's manufacturing and distributing operations.

San Juan

Chartered March 31, 1954

Scott-St. Louis

Chartered as St. Louis Chapter October 31, 1947
Re-Chartered as Scott-St. Louis Chapter November 23, 1951

On July 20th, chapter members and their families attended the St. Louis Cardinal and Brooklyn Dodger baseball game at the Busch Stadium in St. Louis.

The chapter reports that, except for the fact that the Cardinals lost 4-1, the outing was a big success.

Seattle

Chartered January 1, 1948

South Texas

Chartered March 19, 1954

The "San Antonio Light" was host to the chapter on July 6th and provided an interesting tour of its mechanical plant, starting from the editorial rooms and down through the presses.

Members also had an opportunity to see the preparation of the news for a Sunday edition, starting with the written copy, going into the metal, then into the curved plates, and finally going through the presses. The complete progress of a news story from the time it is written until the time it appears in the paper was followed.

On August 2nd, by invitation of Brig. Gen. DeCoursey, Commandant of the Army Medical Service School at Fort Sam Houston, a limited number of chapter members joined the group at the school as observers of the mass casualty demonstration at Camp Bullis.

This was a regular medical training maneuver conducted by the Army Medical Service School to demonstrate and test new techniques in the handling of mass casualties and the problems of atomic attack. The field demonstration illustrated on the ground the area occupied by an infantry division in the attack and the impact on the medical service of the division. The maneuver covered new types of aid stations, field hospitals, mobile field stations and the general problems of handling mass casualties.

Southern California

Chartered October 15, 1948

The chapter's annual meeting was held on June 12th at the Town House in Los Angeles. The main item of business was the election of officers for the coming year.

Charles A. LaHar, Radio Corporation of America, was re-elected president. Vice-presidents are: Lester R. Daniels, L. Daniels & Associates; R. O. Vaughan, Marvelco Co.; secretary — Jack Warner, Jr., Warner Bros. Pictures, Inc.; treasurer — Ray Meyers, Lockheed Aircraft.

Board of Directors: L. D. Callahan, Gilfillan Bros.; Holman H. Dillard, Technical Development Corp.; Charles F. Horne, Convair, Inc.; L. W. Howard, Triad Transformer Corp.; John W. Inwood, Western Union; Loyd C. Sigmon, Radio Station KMPC; John Aalberg, RKO Pictures, Inc.; Lt. Gen. Elwood R. Quesada, USAF (Ret.); John Atwood, Hoffman Electronics, Inc.; Richard Fuller, Bendix-Pacific.

Southern Connecticut

Chartered October 8, 1953

Southern Virginia

Chartered July 22, 1954

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Switzerland

Chartered as Geneva Sub-Chapter of Paris August 23, 1954
Chartered as Switzerland Chapter January 23, 1956

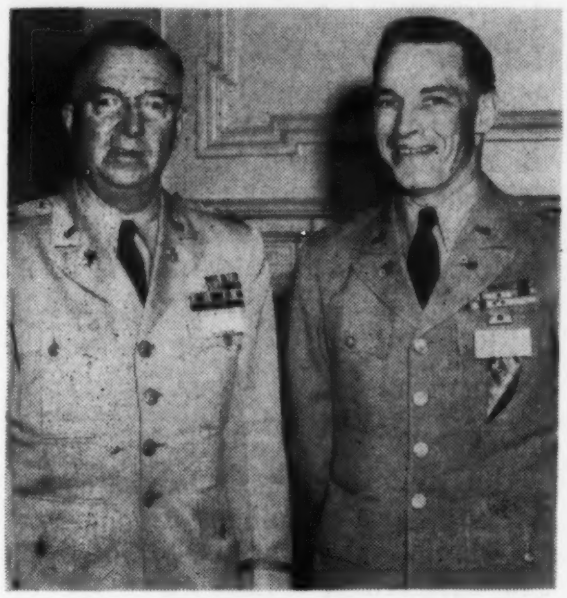
Tinker-Oklahoma City

Chartered November 30, 1953

Professor Clyde, L. Farrar, chairman of the School of Electrical Engineering, University of Oklahoma, was guest speaker at the June 22nd meeting. His subject was "Automation" and he gave an interesting explanation of the "closed circuit" concept as applied to automation.

A film, "Automation of Television," followed Professor Farrar's speech. The film depicted the automation processes employed by the Admiral Corp. in the manufacture of television sets.

As a result of the great interest displayed in the subject of automation,



Maj. Gen. James D. O'Connell, Army Chief Signal Officer, and Capt. Frank D. Stevens, Signal Corps, faculty advisor, Northeastern University Chapter, AFCEA, at May Convention in Boston

President Loyd G. Dorsett appointed John C. Mercer, 1800th AACS Wing, to arrange another program on the subject in the fall. It is planned to have this follow-up program present an analysis of the effect of automation on military and civilian life and the impact on skilled vs. unskilled labor.

Tokyo

Chartered as Far East Chapter December 3, 1947
Re-named Tokyo Chapter October 21, 1954

Washington

Chartered October 11, 1946

Student Chapters

Iowa State College

Chartered May 8, 1953

New York University

Chartered February 24, 1948

Northeastern University

Chartered December 5, 1952

Norwich University

Chartered March 31, 1954

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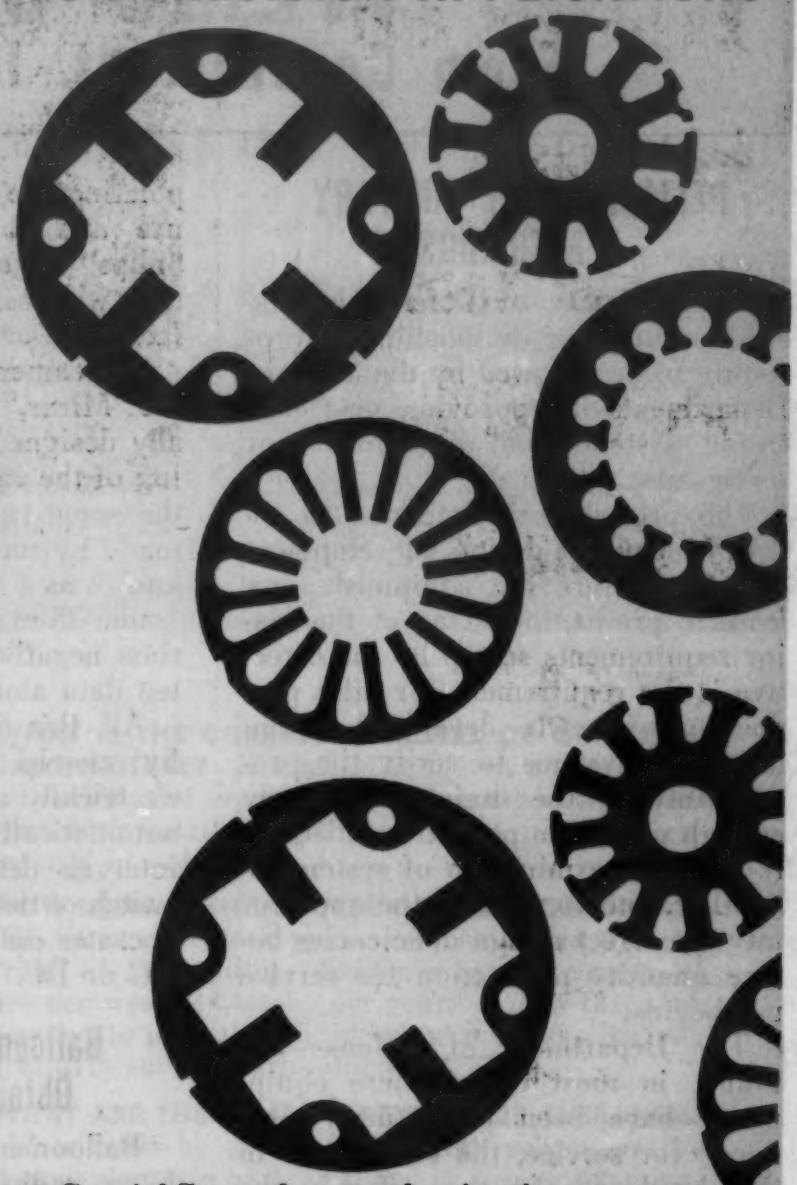

■ Special Syntork motor laminations are now available for precision applications such as Servo-mechanisms, Resolvers, Synchro-motors, Tachometer Generators, Induction Potentiometers, and Motor Generators. Experience gained in producing hundreds of special dies enables Magnetic Metals Company to provide the following desired properties:

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ITEMS OF INTEREST

From Government, Industry and the Services

RELIABILITY OF MILITARY ELECTRONICS

The Secretary of Defense has issued a directive establishing a procedure to be followed by the Military Departments in approving new electronic systems and equipment for service use.

The procedure is intended to assure adequate design development and test before the equipment's release to production. One of the major requirements set up by the directive is the requirement for pilot production of newly developed equipment and systems to verify the producibility of the design, to supply enough models to permit a statistically sound determination of system reliability, and to provide the opportunity to correct design deficiencies before quantity production for service use begins.

The Department of Defense has found, in most cases where equipments have been prematurely produced for service, the small gain in time has been more than offset bv the resulting delays in production and in-service reliabilitv problems. These problems include costly design changes in established production lines, retroactive field changes to remove equipment deficiencies, and the additional effort required of maintenance of inadequately designed and tested equipment.

Maritime Radar Camera

A specially designed maritime radar camera, developed by the Fairchild Camera and Instrument Corp., could be of material assistance in fixing responsibility for collisions at sea, it was recently revealed.

The camera, which automatically takes pictures of a ship's radarscope, was designed by Fairchild engineers for use on vessels operating in congested areas or during fog and heavy weather.

The film would indicate whether the radar sets on each of the ships were functioning properly at the time of the collision. If the radars were operative, the film would show the relative position of the two ships, at fixed time intervals, prior to and at the moment of impact. Not only could courses be determined, but by interpolating the time intervals of exposure and the relative distances of "blips" on the screens, the speed of the two vessels could be accurately fixed.

The camera, which has been named the "Mirar," is the first to be specifically designed for ships. Direct viewing of the radar image is provided at the same time that photographs are made by means of an optical system known as a beam splitter. Each single frame 35-mm photograph records the time negative number and handwritten data along one edge.

All this information is provided by merely flicking a switch. The electrically operated "Mirar" camera automatically makes photo records at intervals determined by the selection switch of the control box. The camera operates on 24 volts DC or 110 volts AC or DC.

Balloon-Supported Rockets Obtain Scientific Data

Balloon-supported rockets, fired by a radio signal from shipboard, are expected to obtain important scientific data during the International Geophysical Year that will lead to improved radio communications.

In preparation for the IGY, scientists from the Naval Research Laboratory fired 10 balloon-supported rockets, or "Rockoons," from the *USS Colonial*, some 200 to 400 miles west of San Diego, Calif., during a two-week period, which began July 16.

This large-scale attempt to learn more about the effects of solar "storms" or "flares" on radio "fade-outs" was a preliminary to more extensive rocket explorations of the upper atmosphere to be made during the IGY.

Plastic balloons, 68 feet in diameter, supporting 12-foot long rockets carrying an instrument payload of 20 pounds, were launched from shipboard in the morning. The "Rockoon" floated above the ocean until a solar flare was observed. At this time, a radio signal from a transmitter aboard the ship fired the rocket. In the next two minutes, the rocket reached an altitude of 60 to 70 miles above the earth, within the ionosphere, and radioed back to the observing station aboard the ship, data on the strength of X-ray and ultraviolet radiation from the flare.

(*Continued on page* 104)

Shown below is a demonstration of how the Bell Telephone Laboratories' experimental model of the "Picture-phone" is used. Picture transmission for this system will require only one more telephone line on a customer's premises. The picture measures 2 x 3 inches. Protruding above it is the camera lens.

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E. H. RIETZKE, President, CREI
Capitol Radio Engineering Institute

• *One of a series of institutional messages.*

The President of CREI asks . . .

Can a Technical Institute train the kind of men You need?

THERE are a number of good Technical Institutes. CREI, as one of America's leading Technical Institutes offering ACCREDITED CURRICULA, invites you to answer the above question after reading our ideas on the subject, as expressed below.

1. WHO ACCREDITS THE CURRICULA OF TOP TECHNICAL INSTITUTES? Capitol Radio Engineering Institute curricula have been accredited for a number of years by Engineers' Council for Professional Development, the nationally recognized organization for the accreditation of the curricula of engineering colleges and technical institutes. CREI is a founder member of the National Council of Technical schools which first established strict educational and ethical standards for this important area of technical education. CREI is listed in the U. S. Office of Education Directory, "Higher Education". CREI is authorized by the District of Columbia Board of Education to grant the Degree of Associate in Applied Science.

2. WHAT KIND OF PERSONNEL DO WE TRAIN? Our Institute trains sound, *practical* engineering personnel who "can get a job done". This is especially important in view of the growing trend in engineering colleges toward less and less specialization. Their major emphasis is on turning out broadly educated men qualified for basic research assignments. Both are essential.

3. ARE TECHNICAL INSTITUTE GRADUATES "TECHNICIANS" OR "PRACTICAL ENGINEERS?" CREI does not claim to turn out "Engineers" in the accepted professional meaning of the term. However, the term "Technician", as very often used in the field and as customarily applied to graduates of technical institutes, in our opinion is not an adequate designation for our graduates. In fact, graduates of CREI start in practical engineering capacities and at average salaries generally equivalent to those of engineering college graduates.

4. WHERE ARE TECHNICAL INSTITUTE GRADUATES QUALIFIED TO START? CREI graduates are qualified to start, and do start in industry, in a supporting engineering capacity, in production, design or testing, alongside of graduates of engineering colleges. While the latter may ultimately be of maximum value in research assignments, the technical institute graduate will generally find his most useful role as project engineer, design engineer or field engineer.

5. WHAT IS THE CURRICULUM LEVEL OF OUR TECHNICAL INSTITUTE? It is of college level, and is highly practical in the applications of mathematics and theory with relation to the practical problems encountered in industry.

6. HOW LONG IS THE COURSE OF INSTRUCTION? At CREI three collegiate years are condensed into an average of 26 months. Students attend classes 35 hours per week, 48 weeks per year. All of this time is devoted to practical engineering subjects. Strictly liberal arts subjects are minimized.

7. WHAT ARE THE QUALIFICATIONS FOR ENTRANCE? Students must be graduates of high school, or the real equivalent (to be determined by proper examination) with adequate preparation in mathematics and science. As a matter of fact, at the CREI residence school, students are accepted only through strict aptitude tests. More than half the applicants are rejected by these tests.

8. WHAT DOES OUR TECHNICAL INSTITUTE OFFER TO STUDENTS? We offer an educational program which will equip them in a minimum of time, for happy professional lives in rapidly growing industry, where advancement will be limited only by their own ambition and willingness to work.

9. WHAT DOES OUR TECHNICAL INSTITUTE OFFER TO EMPLOYERS? To employers interested in hiring men who have a sound background in practical engineering and who "can get the job done", we invite you to join the long list of the nation's leading firms who regularly look to us for new technical talent.

You can do a service to your industry, your company, and technically inclined young men, by understanding this type of educational program and recommending it to interested, qualified personnel. We will gladly furnish complete information upon your request.

For your present technical employees, CREI also offers a home study program at the same high level which will fit them for upgrading into technical positions of greater responsibility. Ask us about it.

CAPITOL RADIO ENGINEERING INSTITUTE

Accredited Technical Institute Curricula

Dept. 219-C, 3224 Sixteenth St., N.W., Wash. 10, D. C.

ITEMS OF INTEREST

In addition to the telemetering transmitted, the rocket contained detectors, known as photon counters, which are sensitive to radiation from the sun in three wavelengths—1216 angstroms, 1 to 10 angstroms, and 0.05 to 1 angstrom. These wavelengths correspond to the Lyman-alpha line of hydrogen, X-ray, and "soft" gamma rays, respectively, which are believed to have independent but accumulative effects on the ionosphere, and hence on radio fadeouts. The data telemetered to the ship from the counters will be evaluated to the scientists at a later date.

NBS Develops High-Speed Adder

Research at the National Bureau of Standards on the logical design of electronic computers has resulted in a method for adding two 53-binary-digit numbers in 1 microsecond. When incorporated into a computer's arithmetic unit, this adder will provide a significant saving in time over the currently used parallel adders in solving complex scientific computation and data-processing problems.

The high speed of the adder results from a logical arrangement that permits the simultaneous formation of large groups of "carries," the numbers that are carried over to the next more significant digital positions in addition problems. It can be constructed from electronic circuitry similar to that in the National Bureau of Standards Electronic Computer, the SEAC.

In the Bureau's method of addition, whole groups of adjacent carries are formed simultaneously and independently. An analysis using Boolean algebra techniques shows that it is feasible to generate all carries in a limited number of time periods. Specifically, for a 53-binary-digit adder, all 52 carries are formed in only 3 steps of a 5-step operation.

COMPUTER SYMPOSIUM

Problems and experiences with medium-sized electronic computers will be the theme of the third annual Computer Applications Symposium sponsored by Armour Research Foundation of Illinois Institute of Technology. The symposium will be held in Chicago, October 9 and 10.

The symposium program has been arranged in recognition of a heightened interest in the problems and performance of electronic calculators.

Twelve speakers at the two-day meeting will deal with the utilization of a number of machines in the medium scale, including the IBM 650, Datatron, and others. All speakers will represent organizations in which the instruments are in use.

The symposium subjects will include problems encountered in installing computers, problems of revising programs to give effect to changes in procedures, use of computers on problems which could not be solved by other methods, and methods of approach and personnel required.

Pictured on the right is a forward scout reporting back to his squad through a small combat radio built into his helmet. He talks into a thumbsized microphone that slips easily under his helmet when not in use. Designed by the Signal Corps Engineering Laboratories, the radio unit weighs less than a pound including batteries.

Closed Circuit TV Demonstrated for Educators

In the first demonstration of closed circuit television in a secondary school in the Philadelphia area, a biology class was conducted over the closed channel to an audience of some 1,000 persons at the Upper Darby High School. The Jerrold Electronics Corp. of Philadelphia installed the master antenna system which made it possible for the demonstration to show commercial as well as the classroom programs.

Both the educators and administrators from the suburban area and the students saw the demonstration on conventional TV sets, with a small group of guests also viewing it on the school's giant auditorium screen. In the classroom, four cameras from the General Precision Laboratory, Pleasantville, N. Y., were used, with a student on cue from the instructor controlling the camera on the circuit.

Combat Helmet Radio

The Signal Corps Engineering Laboratories at Fort Monmouth, N. J., has developed a combat helmet radio to bring walkie-talkie communications to the individual rifleman for the first time.

The experimental helmet looks like a football player's headgear and contains the smallest known two-way military radio, weighing only a pound. The set was made smaller than two packs of cigarettes by use of transistors instead of bulky vacuum tubes.

To prevent enemy interception of messages at the front lines, the helmet radio is preset for short range conversations between squad members. At a moment's notice, however, range can be greatly increased by attaching an auxiliary antenna to the top of the helmet.

To answer a call, the soldier merely flips a switch and talks into a microphone about the size of his thumb. No warm-up time is needed. The set's transistors act instantly.

At full capacity, the helmet can reach radios up to a mile away, and can hear powerful stations at even greater distances.

Contractors Named For Missile System

Contractors participating in the Air Force's strategic ballistic missile development program were named at the recent Air Force Association convention in New Orleans, La. The 17

UMI

contractors are working on the construction of three missiles, two intercontinental missiles, Atlas and Titan, and an intermediate range missile, Thor.

Ramo-Wooldridge's Guided Missiles Research Division, Los Angeles, Calif., has the system's engineering responsibility and provides technical direction for all of the contractors in the program.

Contractors for the missile guidance portion of this program are General Electric's Defense and Electronics Division, Syracuse, N. Y.; Bell Telephone Laboratories, Whippany, N. J.; The American Bosch Arma Corp., Garden City, L. I.; the A.C. Spark Plug Division of General Motors, Milwaukee, Wisc.; Burroughs Corp., Paoli, Pa., and Remington Rand, the Univac Division, St. Paul, Minn.

The air frame contractors include the Convair Division of General Dynamics Corp., San Diego, Calif., who are working on the Atlas missile air frame, the Martin Co., who are constructing the Titan air frame in their Denver plant, and Douglas Aircraft Co., Santa Monica, Calif., who are developing the Thor air frame.

Contractors for the propulsion area of the missile program are North American Aviation Corp., Canoga Park, Calif.; Aerojet-General Corp., Sacramento, Calif.; and American Machine and Foundry Co., Turbo Division, Pacoima, Calif.

General Electric and AVCO Manufacturing Co. are contractors for the nose cone which houses the nuclear or thermonuclear warhead.

The Air Force strategic ballistic missile program is the responsibility of the Air Research Development Command. Immediate control over all developmental aspects of the program is exercised by the Western Development Division of ARDC in Los Angeles, Calif.

U. S. Firms Informed of European Technology

A program, known as the European Technological Observation Group plan, has been established by Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill., to keep American industry informed of European technical development.

The service is being offered by the Foundation to firms interested in ideas and techniques of potential value in the American market. Eighteen companies are participating in this unique plan.

(*Continued on page* 106)

ANOTHER EXAMPLE OF Waterman PIONEERING . . .

The Waterman PANELSCOPE is a custom-built cathode ray tube oscilloscope, with simplified operation, and yet available at a low price. The PANELSCOPE concept provides for the following:

- MINIATURIZATION — Panel space required is only 5¼" x 5-3/16" — depth is 10" and the weight is less than 5 lbs. The PANELSCOPE can be installed in practically any equipment — mobile or stationary air, sea, or land — military or commercial.
- SIMPLICITY OF OPERATION — Twist of a single rotary switch provides a synchronized pattern of desired incoming signal (up to 11 circuits) against proper linear time base. This is ideal for monitoring and trouble shooting, as it removes the need of fiddling with knobs as it is done now on general purpose oscilloscopes. The static controls, such as beam, focus, positioning, and graticule brightness are located in tube escutcheon.
- CUSTOM DESIGN — A wide variety of — signal amplifiers with response from dc to megacycles and sensitivities from 5 millivolts — synchronized or triggered linear time base generators from ½-cycle (and lower if need be) to 2 microseconds — can be specified by you to fit your needs for particular equipment.
- PARTIAL KIT FORM — The PANELSCOPE comes fully wired and tested with chosen signal amplifier, linear time base generator and attendant sync. amplifier. The desired signal attenuators, frequency and amplitude determining components, and method of synchronization can be installed either by us or by you.
- POWER REQUIREMENT — Less than 10 watts of line power for built-in high voltage supply — The required B+ and heater current as selected by your requirements. For those cases where B+ and heater power is not available, auxiliary power pack can be supplied.

There is a place in your equipment for Waterman PANELSCOPE, a custom built oscilloscope at production prices, although your needs may be but one or two. May we have your requirements?

WATERMAN PRODUCTS CO., INC.

PHILADELPHIA 25, PA.

CABLE ADDRESS: POKETSCOPE

MANUFACTURERS OF

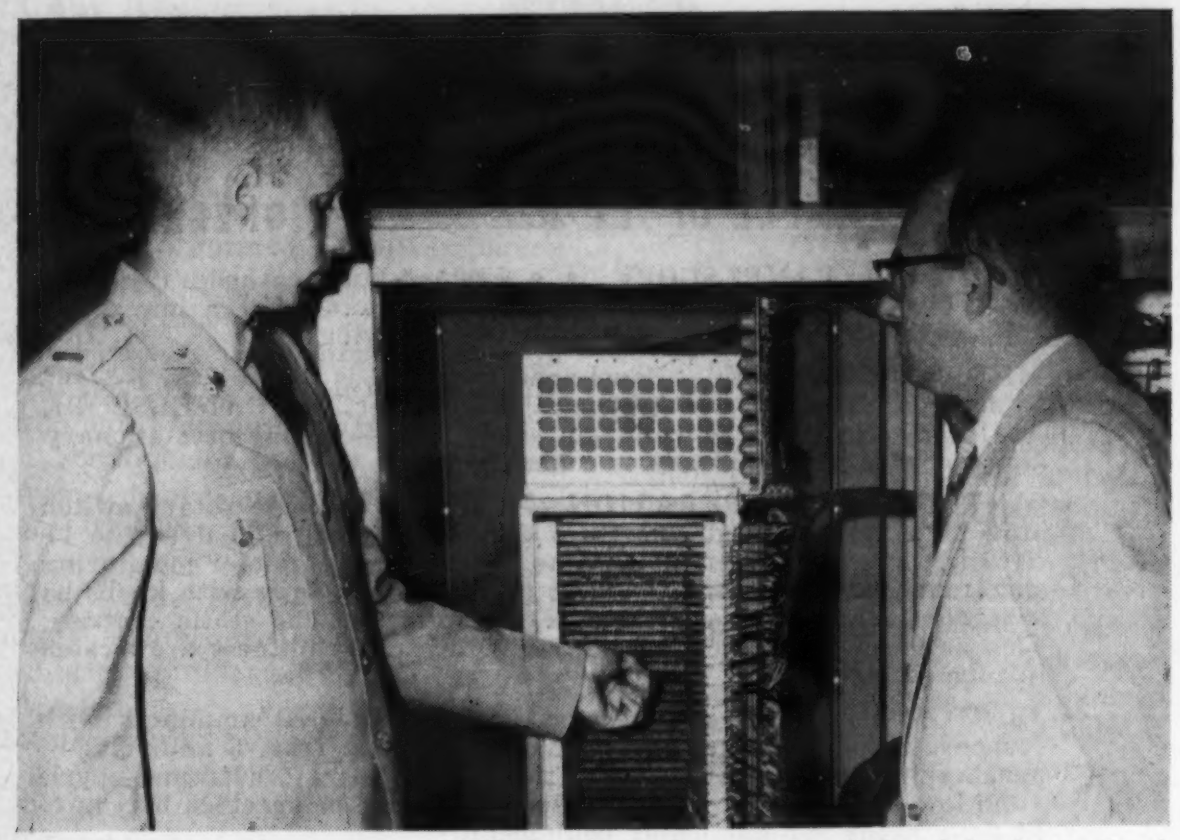
PANELSCOPE*
S-4-C SAR PULSESCOPE*
S-5-C LAB PULSESCOPE*
S-11-A INDUSTRIAL POCKETSCOPE*
S-12-B JANized RAKSCOPE*
S-12-C SYSTEMS RAKSCOPE*
S-14-A HIGH GAIN POCKETSCOPE*
S-14-B WIDE BAND POCKETSCOPE*
S-14-C COMPUTER POCKETSCOPE*
S-15-A TWIN TUBE POCKETSCOPE*
RAYONIC* Cathode Ray Tubes and Other Associated Equipment

*T. M. REG.

ITEMS OF INTEREST

From the observation group's headquarters in the Hague, Netherlands, a staff of five engineers will observe and report on European production methods in the fields of mechanical, electrical, and chemical engineering, metallurgy, and chemical production.

The staff will scour Western Europe for ideas, developments, and methods that will help sponsoring companies improve their competitive positions. They will spend the major portion of their time attending all important seminars, conferences, trade shows, and technical meetings. Observers will visit scientific, technical, and industrial organizations.



Pictured above is the memory unit of the electronic computer designed by International Business Machines Corporation for the Army Signal Corps computer-communications system, installed at the Army Signal Supply Agency in Philadelphia. The computer is a key element of the electronic data processing network that handles requisitions, stock control, and other data pertaining to signal supplies for the entire U. S. Army.

OPERATION ALERT PROVES TELECOMMUNICATIONS ADEQUATE

Operating from a secret relocation center, Government telecommunications officials, assisted by consultants and Executive Reservists from commercial communication companies attached to the Office of Defense Mobilization, put into play a number of problem plays designed to reveal the flexibility and adequacy of the Telephone by-pass systems—during Operation Alert, the week of July 23, 1956. Within 24 hours after the "attack" on 76 target areas took place, Maj. Gen. Jerry V. Matejka, USA (Ret.), Assistant to the Director, Office of Defense Mobilization, was appointed Administrator of the War Communications Administration which was established in the course of the exercise.

Using the communications powers of the President delegated to him under the 1934 Communications Act, General Matejka immediately issued a series of orders designed to insure the control and continuity of vital wire and radio channels, and to decentralize authority sufficiently for the emergency. It was considered unnecessary to curtail public use of the usual facilities in view of the priority system already set up.

The following measures were ordered by General Matejka: Federal Government control was extended to intra-state communications in the continental U. S. and the territories, posessions, and District of Columbia; the Secretary of Defense was authorized to use, control, supervise, inspect or close all maritime radio facilities under U. S. jurisdiction; the FCC was authorized to close all amateur radio stations not licensed in the Radio Amateur Civil Emergency Service, and to expand its radio monitoring to prevent unauthorized transmissions; the precedence system for public use of available communications facilities was made mandatory (telephone, telegraph, and teletypewriter exchange); the precedence system for the resumption of intercity private line service was made mandatory, to insure priority restoration of vital lines, and all outstanding authorizations for the use of all radio frequencies were ordered to remain in effect until superceded by further orders from General Matejka.

The play was restricted to the domestic communication complex of the United States and the vast national network of both telegraph and telephone facilities received careful scrutiny throughout a number of areas in the Nation in an effort to determine the adequacy of that part of the complex which remained undamaged from enemy "attack."

G-E Silicon Rectifiers

The General Electric Co. has announced two new silicon rectifiers designed to meet stringent military requirements.

The new rectifiers, RETMA type designated IN537 and IN538, were developed under a U.S. Air Force contract. They are now in full production at the Company's Semiconductor Products Department Plant, Clyde, N. Y.

Both of the new silicon rectifiers are rated at a maximum DC output current of 250 milliamperes at 150° C. However, the devices may be designed into circuits for outputs of up to 750 milliamperes where lower temperature conditions are encountered. Maximum leakage current over the devices' entire ambient operating temperature range of from —65°C to 150°C is 0.5 milliamperes.

A prime feature of the new rectifiers is that high current loads can be carried without the use of any heat sink whatsoever. Thus, the new silicon rectifiers are suitable for computer power supplies for many applications such as guided missiles, blocking applications, magnetic amplifiers, other low leakage applications, and a wide variety of high temperature electronic equipment power supplies.

The IN537 silicon rectifier is rated at a maximum peak inverse voltage of 100 volts, while the IN538 is rated at a maximum PIV of 200 volts. Maximum surge current for both rectifiers is 10 amperes. Full cycle average forward voltage drop is a maximum of one-half volt for both devices.

TV Camera Observes Navy Weapons Tests

A television camera, which will contribute to efficiency and safety in weapons testing, was demonstrated at the Chincoteague, Virginia, Naval Air Station by the Navy and the manufacturer, General Precision Laboratory of Pleasantville, New York.

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Representatives of the Navy, Air Force, and Marine Corps were able to observe performance of the advanced weapons from a distance of three feet—the distance the television camera was located from the weapons —while looking at a movie-size screen situated 150 feet from the firing bay.

The display by the Aircraft Weapons Department of the Naval Aviation Ordnance Test Station was made possible through the use of a rugged television camera mounted on a tripod close to the firing weapon inside the test chamber and another small, five-pound camera peering through the glass observation port in the two-foot-thick concrete wall at the rear of the chamber.

Pictures from either camera, controlled by a switching device, were relayed to a television projection system in the viewing room where the group of officials was able to watch the proceedings safely.

The closed-circuit television equipment transmitted clear, detailed pictures of the tests despite noise levels well over 120 decibels and the shock waves produced by the weapons.

Admiral Begins Radiation Survey

The future design and construction of atomic powered rockets and space satellites may be determined by a study of radiation damage to electronic components undertaken for the U. S. Air Force by Admiral Corp., Chicago, Ill.

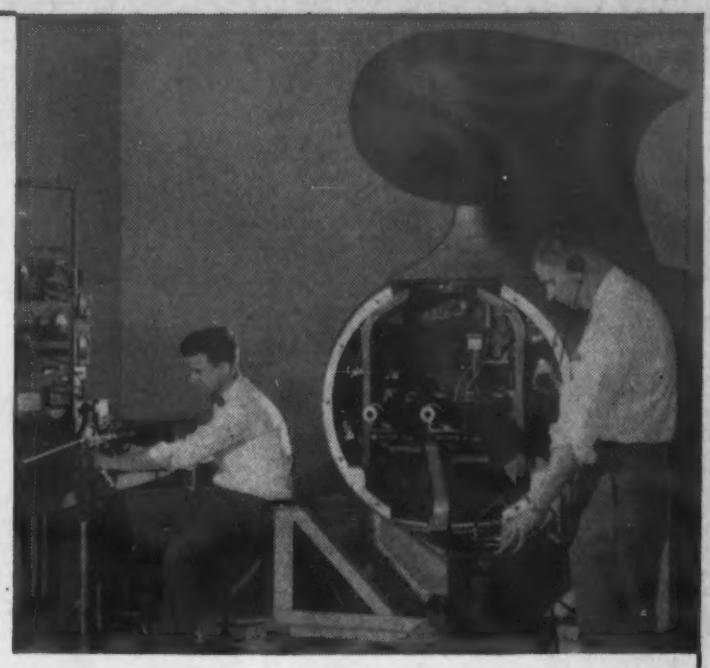
As part of the project, all types of electronic components are being bombarded and tested with neutrons. The testing is conducted at six-day periods with nuclear reactors at the Government's Argonne Research Laboratory at Lemont, Ill., and at an Atomic Energy Commission Installation at Arco, Idaho.

After being tested in the reactors, the radioactive isotopes are transported in lead shields to a specially designed nucleonic laboratory near Admiral's headquarters. The laboratory contains shielded rooms in which the latest test equipment has been installed. Here the radioactive components are tested with apparatus operated by remote controls outside the room. The operator has a full view of the interior through a special glass window approximately two feet thick.

One shield room contains environmental chambers to simulate extreme temperatures and altitude conditions in which operation of the radioactive components may be required.

(*Continued on page* 108)

If You Have RADAR In Mind As A Career



Here's a marvelous opportunity for you with the fast growing CROSLEY Division, AVCO Manufacturing Corporation. New projects are being started and you will be able to get in on the "ground floor" with this young and agressive organization. We will pay your expenses to Cincinnati if you are accepted. We urge you to contact us without delay.

CALIBRATION ENGINEERS

You will perform production tests on RADAR Systems and other complex electronic equipments. You will interpret data obtained by observation of wave-shapes, frequency-measurements and mathematical calculations to indicate acceptability of units to specified requirements. Diagnose the causes of equipment failure and direct the making of necessary repairs. Two years of technical or service school or the equivalent is required with two to three years' experience in radar maintenance and repair.

ELECTRONIC TECHNICIANS

Here you will be interested in quality control and production problems. Two to three years of specialized training in service radar schools or the equivalent. Also, practical experience in radar is important.

Crosley DIVISION
AVCO MANUFACTURING CORPORATION

2630 Glendale-Milford Road
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"Known For The NEWEST – Respected For The BEST!"

Please send a resume to Employment Manager

ITEMS OF INTEREST

The project calls for the testing of electronic components before being subjected to radiation, as well as afterward, in order to determine the extent and nature of radiation damage. The results of these tests will be studied by Admiral engineers and physicists during the project's three-year period, and comprehensive recommendations will be made to the Air Force for preventing or reducing radiation damage to components.

New Regular Army Officer Program Announced

The "Armed Forces Regular Officer Augmentation Act of 1956," was recently passed to provide incentive and opportunity for military careers in the Armed Services and to reduce turnover in the officer corps. It provides for the first time since the 1946-47 integration, general authority for appointment of Regular Army officers above the permanent grade of first lieutenant.

The Army's statutory Regular commissioned officer authorization has been increased from 30,600 to 49,500 by this act. Present Regular officer strength chargeable against this authorization is about 27,000.

Appointment in the Regular officer corps may be made without restriction as to permanent grade. However, any officer appointed under this act must be of such age as to permit him to complete twenty years of active commissioned service before his 55th birthday. This may include periods of service both before and after appointment.

The maximum age for appointment without promotion list credit is twenty-seven. This base age of twenty-seven may be increased by the amount of promotion list service credited at appointment.

Stromberg-Carlson Device For Air Traffic Control

A commercial version of the Charactron shaped-beam tube which has been used for some time in the SAGE system of military aircraft surveillance has been announced by the Stromberg-Carlson Division of General Dynamics Corp. Providing an extremely clear moving diagram, the tube, which has a 19-inch diameter screen, can also print letters and numbers to represent such information as flight number of the plane, speed, and altitude.

The new tube will be useful both for civil and military air terminals when combined with individually engineered control panels, radar, and electronic computers to create improved air traffic control systems. One of the advantages of the device is the tremendous speed with which it can reproduce information.

Pictured above is the XY Universal switch, manufactured by Stromberg-Carlson. It is one of the electromechanical switches, originally designed and built for service in telephone systems, now available for industrial application.

Navy Helicopter TV Stations

Helicopters may become self-contained flying television stations during major naval operations. Developed at Philco Corp.'s Government and Industrial Division for the Navy Department's Bureau of Ships, a new airborne TV system is said to provide operation over line-of-sight distances of more than fifty miles.

This system, an ultra-high frequency FM radio link, provides for transmission, reception and display of television information from the air to surface ships. During recent tests with the fleet, the Navy reported that excellent pictures were obtained of all phases of ship-to-shore movement.

The airborne equipment for the new Navy TV system includes a frequency modulated transmitter of 100 watts effective radiated power, an image orthicon camera, a coder, and a high-gain antenna.

Personnel

General Maude Joins Du Mont

Maj. Gen. Raymond C. Maude, former commander of the Air Force Cambridge Research Center, Air Research and Development Command, has joined Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

General Maude will assist Dr. Thomas T. Goldsmith, Jr., vice president, government and research, in directing and coordinating Du Mont's extensive program of supplying electronic equipment to the Armed Services. He assumed his new duties immediately after his retirement from active duty.

As Commander of the Cambridge Research Center, General Maude has worked closely with the Lincoln Laboratory and master planning for the continental defense of the United States, as well as many other advanced military programs.

Pernice New Director For Collins Radio Ltd.

Newly appointed Managing Director of the Collins Radio Co. of England, Ltd., is Joseph R. Pernice, president of the Paris Chapter of the AFCEA. Mr. Pernice has been Chief of the Electronics Section of NATO's Production and Logistics Division for the past six years.

Active in electronics for 30 years, he held several Government technical production positions during World War II. In his NATO post Mr. Pernice directed the activities of the international groups on electronics. Their purpose has been to exchange technical information, aid in the development of production plans and further standardization among member nations.

Organized last year as a subsidiary of the Collins Radio Co. of Cedar Rapids, Iowa, the British branch has functioned as a sales office for the United Kingdom and Europe. It serves also as a maintenance facility for Collins equipment used by international air carriers and other commercial customers.

RCA Names Missile and Radar Head

The Radio Corp. of America has announced the appointment of Harry R. Wege as manager of RCA Missile and Surface Radar Department.

Mr. Wege has been operations manager of the department since its establishment last November to coordinate the company's activities in both missile and surface radar production.

The department, under Mr. Wege's direction, is currently engaged in the development and production of land-based tactical launching and guidance systems for the Air Force's "Talos" surface-to-air guided missile.

A member of the Philadelphia Chapter of AFCEA. Mr. Wege joined the Association in 1953.

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PERSONNEL CLEARING HOUSE

AFCEA Members Available to Industry

The pages of SIGNAL are open to active AFCEA members who are seeking positions in the communications, electronics and photographic industries. Any member is entitled to space free of charge in this column for three issues of the magazine. Please limit your notice to five lines. In replying, employers are asked to address: Box ——, SIGNAL, 1624 Eye Street, N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

DISTRICT SALES MANAGER OR FIELD REPRESENTATIVE for electronics or associated firm. Excellent contacts with industry and Government agencies in 11 Western states. Fully cognizant of Western industrial expansion. Familiar with all Western Government projects and R&D operations. Capable of setting up Western office, advertising program, marketing, distribution program. Box 120.

SALES ENGINEER: ADVERTISING—SALES PROMOTION MANAGER. Recent sales experience plus 10 years' experience in advertising and sales promotion of electronic products. Radio amateur for over 20 years. Age 37. Engineering education of 3 years and B.S. in Marketing degree. Prefer West or East coasts. Box 121.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

ORDNANCE ENGINEER ($7,000/year). Assistant Inspector of Naval Material, Germantown, Pa., has opening in development and production of ordnance equipment. Requirements: Bachelor's degree in engineering (or four years' equivalent experience) and 2½ years' engineering experience, one in ordnance engineering. Master's degree can be substituted for one year's experience; Doctor's degree in ordnance engineering can be substituted for all experience. For further information, write: Supervising Inspector of Naval Material, 17 Brief Ave., Upper Darby, Penna.

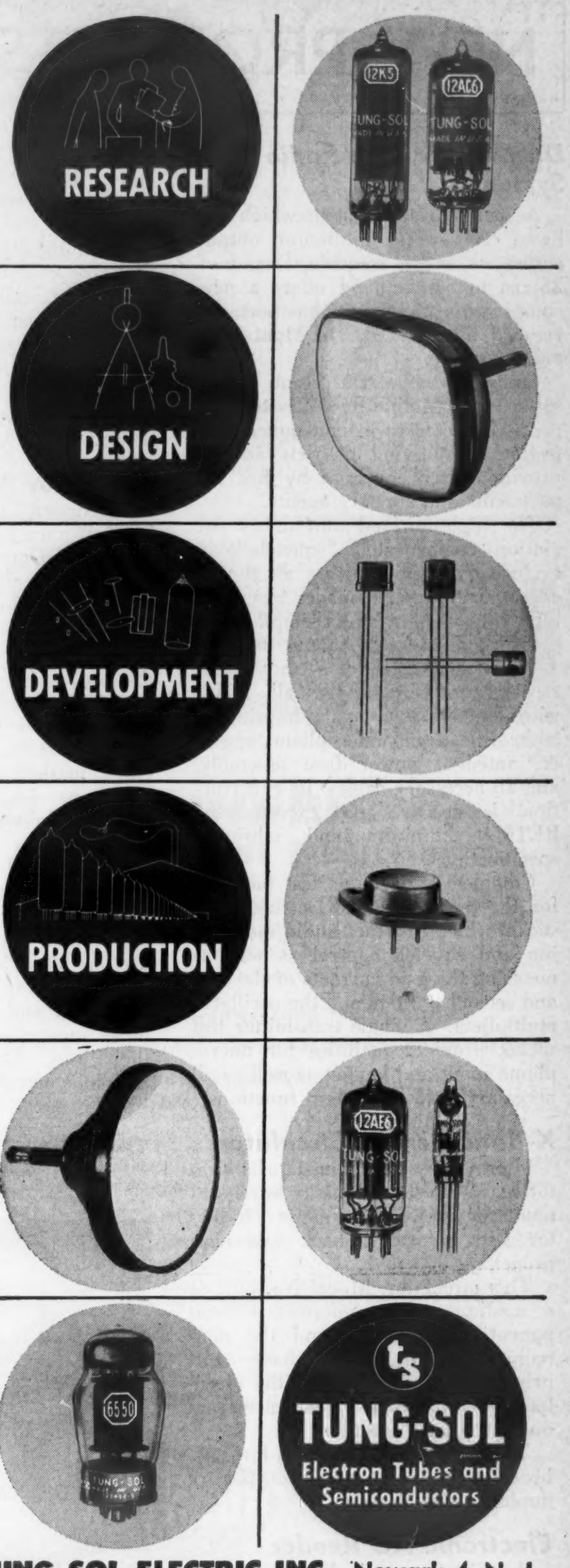
ELECTRONIC ENGINEERS, ELECTRONIC SCIENTISTS, MECHANICAL ENGINEERS, starting salaries $5,335-$6,390. ENGINEERING DRAFTSMEN, $3,415-$4,080. Vacancies now exist at the U. S. Navy Electronics Laboratory, a major West Coast scientific organization engaged in research and development of electronic equipment and systems. For further information address: U. S. Navy Electronics Laboratory, Civilian Personnel Division, San Diego 52, California.

ELECTRONIC ENGINEERS: One Electronic Engineer (telephone) and one Electronic Engineer (radio), starting salary $6,390. Requirements are: degree in electrical engineering and 2½ years professional experience, one year of which must have been in the specialized field, or 6½ years professional electronic engineering experience. Applications should be forwarded to: Hqs., 5001 SU Station Complement, 5th Army, 1660 E. Hyde Park Blvd., Chicago 15, Illinois.

THE SPECIAL DEVICES CENTER, an activity of the Office of Naval Research, located at Sands Point, Port Washington, Long Island, has several vacancies for electronic engineers at $6390 a year, and one vacancy for a general engineer at $6390 a year which requires specialized experience in audio-visual recording. Inquiries should be directed to the Industrial Relations Officer. Telephones: Flushing 7-8300 and Port Washington 7-3800.

RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.



TUNG-SOL ELECTRIC INC., Newark 4, N. J.

SALES OFFICES: ATLANTA, COLUMBUS, CULVER CITY, DALLAS, DENVER, DETROIT, MELROSE PARK (ILL.), NEWARK, SEATTLE
CABLE ADDRESS: TUNGSOL

NEW PRODUCTS FROM INDUSTRY

Du Mont Mobile Radio System

A mobile radio system which delivers 100 watts minimum output across its entire frequency band of 25 mc to 54 mc, and offers a new combination of features has been developed by Allen B. Du Mont Laboratories, Inc.

Designated the Du Mont Model MCA-105 B Mobile Radio System, its use is expected to extend police protection to outlying districts and to provide better coverage by fire departments and forestry agents.

The high-powered unit offers deviation compensated "squelch," an exclusive design allowing all tuning adjustments to be made from the top of the chassis, and a simple selector for one-to-four channel tuning.

The system includes a transmitter, receiver, power supply, all relays within a single compact housing, a control head and microphone, speaker, antenna, power fuse assembly, and all necessary cables. Its construction is sturdy and exceeds the RETMA humidity and vibration specifications.

Complete and simple test facilities for the receiver include a single test socket which provides audio monitoring and squelch control as well as metering the grid currents of the first and second limiters and the oscillator multipliers. A single transmitter test socket provides facilities for microphone input and keying as well as all necessary grid and plate functions.

X-Band Ferrite Circulator

Microwave Development Laboratories, Wellesley, Mass., have announced an X-Band Ferrite Circulator with a front-to-back ratio approaching 300 to 1.

This circulator, Model No. 601, is a medium power microwave component developed around the nonreciprocal differential phase shift principle. Power entering the circulator is transmitted in sequence from one terminal to another.

The unit can be used as a low-loss, broad band isolator, or in passive duplexing applications.

Electronic AO Reader

A Film-a-record Electronic AO Reader, designed to accommodate either 16- or 35mm microfilm, was recently manufactured by American Optical Co. and introduced by Remington Rand, a division of Sperry Rand Corporation, 315 Fourth Avenue, New York 10, N. Y.

Electronically operated, it features finger-tip control from high speed to slow speed and stop. It has a 14½" square screen and built-in interchangeable lenses which permit an instant switch from 23 to 1 to 40 to 1 magnification. Mounted on rubberized casters, it can be used in any department.

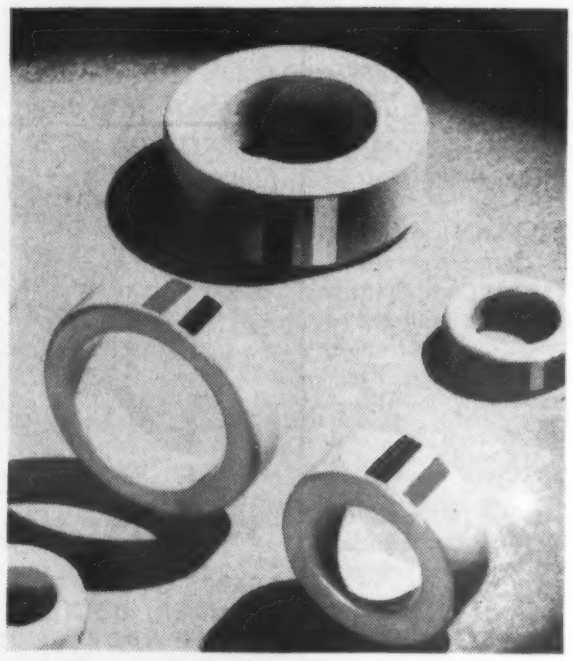
Permalloy Powder Cores

Magnetics, Inc., Butler, Penna., has introduced color coding of their unstabilized permalloy powder cores, which are available on a very short delivery schedule.

The code, established to make the powder cores' use easier on the production line, serves as a guide in assembly so that the proper number of turns may be put on cores without special testing. The cores can be color marked in 2% bands from −5% to +15% of the published nominal inductance for 1000-turn winding.

Widely used as loading coil cores to provide suitable response in the audio and carrier frequency ranges, the permalloy powder codes are also used as filters in communications circuits. High Q applications, such as high, low, and band pass filters, and noise suppression filters are some of their uses. They are made of 2% molybdenum, 81% nickel, and 17% iron formula.

Color coding in 2% bands on these Magnetics, Inc. molybdenum permalloy powder cores takes the place of special testing in assembly.



Quartz Trimmer Capacitor

The Electronics Division of the JFD Manufacturing Co., Inc., 6101 16th Ave., Brooklyn 4, N. Y., has announced production of the Model VC11A Fused Quartz Piston Capacitor for use in capacitor networks requiring low-loss and high leakage resistance for 400 cycle operation.

These low loss capacitors may also be used for ultra stable oscillator circuits and as tuning elements in high frequency, low power tank circuits.

The coaxial construction utilizes an invar tuning slug and adjustment screw that is individually fitted to the precision bore cylinder. A silver invar band serves as the fixed electrode.

Special quality control procedures give the VC11A a dissipation factor of less than 0.0002 at 400 cycles to +125°C. The high insulation resistance of the VC11A remains constant, making it suitable for low frequency network applications.

Frequency Measuring System

Developmental or production testing of precision quartz crystals and filters, magnetostrictive filters, and a variety of other components or circuits, is now being accomplished in a most efficient way by the use of an instrument designated as Type FT-XZB Decade Frequency Measuring System.

Available from the Federal Telephone and Radio Co., a division of International Telephone and Telegraph Corp., the instrument may also be used for pre-setting of communications receivers, for monitoring of transmitter frequencies, and for use in incoming inspection departments.

The FT-XZB consists partly of a frequency synthesizer which contains as its frequency standard a 100 kc quartz crystal with an accuracy of 2×10^{-7}. Through the use of precise frequency dividers, the synthesizer provides standard frequencies which, by means of the instrument's mechanical design, may be fixed or varied from 30 cps to 30 mc.

Combined with this synthesizer, in one compact cabinet, is a frequency meter which permits direct measurements from 10 cps to 300 kc and, when used in conjunction with the synthesizer, difference-frequency

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measurements from 10 cps to 600 mc.

The major advantage of this instrument is its compactness and simplicity of operation. Non-skilled personnel can make precision frequency measurements rapidly and without calculations.

Subminiature Tube Mounting

A right angle subminiature tube clamping shield with integral socket for round button base subminiature tubes has been developed by International Electronic Research Corp., 145 W. Magnolia Blvd., Burbank, California.

The right angle configuration provides tube retention through the patented IERC metal-to-glass contact method on the bulb along with the precision fit of the socket. This combination reduces the bulb temperature, gives high tube retention under severe shock and vibration, and maintains effective electrostatic shielding.

The right angle design allows for greater variety of mounting application, permits flexibility in layout design of electronic equipment and helps design engineers solve the problem of crowded components.

Single Unit Resistor-Capacitor

A single unit resistor-capacitor that requires only the space of a tubular capacitor alone has been developed and produced by the Centralab Division of Globe Union Inc., 900 E. Keefe Ave., Milwaukee, Wis.

Called "Tube-R-Cap," the miniature combination is a standard size CC32 tubular ceramic capacitor that also incorporates, on the same body, a ceramic base resistor in parallel.

The unit is designed to permit greater performance and cost savings in applicators where space is at a premium. Tests have shown that this compact combination lends itself to many electronic assemblies and can be used for antenna line applications.

Maximum length of the Tube-R-Cap is .900 inch with an approximate diameter of .280 inches.

Magnetic Recording Heads

Data Storage Devices, a division of the J. B. Rea Co., 1723 Cloverfield Blvd., Santa Monica, Calif., has announced a new and improved line of multiple channel magnetic recording and playback heads for a wide variety of uses, such as computer

(*Continued on page* 112)

New 40-foot, high-gain search antenna to be used with the AN/TPS-1D Signal Corps radar.

FIELD ENGINEERING
WITH A FUTURE – at Raytheon

PLAN YOUR CAREER HERE – for men who have completed their military duty and plan to re-enter civilian life, Raytheon has interesting positions open in field engineering. Field experience has enabled many engineers to become Raytheon executives.

You Can Participate In These Interesting Programs:

MISSILES . . . Air-to-Air, Ground-to-Air and Guidance Systems.

RADAR . . . . . Bombing, Bomber Defense, Countermeasures, Search, Fire Control.

SONAR . . . . . Ship and Airborne.

You will have justifiable pride in affiliating with Raytheon, renowned for "Excellence in Electronics," world's largest manufacturer of surface search radars, magnetrons, klystrons, transistors.

We are primarily interested in men who have field experience and a degree in Electrical Engineering. However, if you have an extensive electronics background which includes missile, radar or sonar field experience, send in your application. Valuable special training prepares you for your assignments.

Attractive salaries, regular reviews for merit salary increases, relocation expenses, paid life and accident insurance, other benefits and allowances. Interesting assignments. Please address your inquiry to E. K. Doherr.

RAYTHEON MANUFACTURING COMPANY
GOVERNMENT SERVICE DEPARTMENT
100 River St., Waltham 54, Mass.

input-output equipment, memory drums, discs, and telemetering recording.

The audio field is also covered with heads for ¼-inch tape, 16mm and 35mm film. Design and construction methods used in these heads has resulted in the practical elimination of all of the major disadvantages previously existing in magnetic heads. To suit the individual needs of the customer, all heads are subject to a wide variety of modifications, such as low and high impedance and bit density capacity for digital use.

Tiny Storage Tube

Able to store up to a million bits of information, a new information storage tube has been developed by the General Electric Research Laboratory, Schenectady, N. Y.

At the heart of the tube is a thin sheet of glass in which 250,000 holes per square inch have been etched and then filled with metal. Information is written onto one side of the honeycomb by an electron-beam scanning method similar to that used in television, and a "reading gun" picks up the data from the opposite side.

In addition to smaller electronic computers with bigger memories, possible applications for the new tube include television cameras and "scan converters." Two methods of reading the information are available. In one method the electron beam erases the screen as it picks off the stored information; in the other the data can be left for re-reading or to be altered or added to by the writing beam.

Impedance Comparator

Type 1605-A Impedance Comparator, newly manufactured by General Radio Co., 275 Massachusetts Ave., Cambridge 38, Mass., facilitates the rapid sorting of electrical components. It indicates directly the percent difference between two impedances without requiring a special bridge balance.

The instrument indicates not only the difference in magnitude between the two components being compared, but also indicates simultaneously the phase-angle difference. These differences are indicated directly on panel meters. On the most sensitive ranges the differences can be determined to 0.01% and 0.0001 radian.

The device is completely self-contained, including a calibrating voltage. The internal oscillator provides frequencies from 100 cycles to 100 kc in decade steps. Meter voltages are available externally to operate recorders, remote indicators, or selecting devices.

The range of impedances which can be compared is nominally from 2 ohms to 20 megohms. Four independent ranges are provided for the impedance-difference ($\pm$0.3%, $\pm$1%, $\pm$3%, $\pm$10%) and the phase-angle-difference ($\pm$0.003, $\pm$0.01, $\pm$0.03, $\pm$0.1 radian full scale).

Radio Transmitting Buoy

Within minutes after a submarine hits bottom, rescue stations can receive the distress signal, "SOS SUB SUNK SOS" because of a remarkable radio transmitting buoy developed for the U. S. Navy by the Servo Corp. of America, New Hyde Park, N. Y.

The instrument also acts as a beacon that locates the exact position of the distressed craft and can transmit over a radius of 60 miles, regardless of the weather. The unit requires no maintenance and can be stored indefinitely. With modification of the code wheel, the buoy is suitable for use by aircraft in distress over water.

Weighing only eight pounds, it is three inches in diameter, 39½ inches in length, and operates on a 5-cell, 7½-volt output magnesium silver chloride battery activated by sea water serving as the electrolyte.

High Power Mobile Radiophone

A mobile two-way radio, rated at 100 watts transmitter power output on any channel in the 25-54 megacycle frequency band, has been announced by Motorola, Inc.

The unit incorporates a dynamotor-vibrator power supply which, at a power intake equivalent to conventional 60 watt mobile radios, provides full rated transmitter output. The transmitter is capable of up to four-channel operation with each frequency crystal-controlled.

Motorola's "sensicon" receiver, the transmitter and power supply are contained in a compact steel case approximately 6 x 15 x 20 inches. The speaker, control head, and microphone are designed for convenient dash-mounting.

The radio set operates interchangeably between six and twelve volts vehicles without adapters or modifications. Models are available for both standard and "split" channel operation.

Silicon Rectifier Stacks

The "TL" series of silicon rectifier stacks which combines the performance of silicon rectifiers with the versatility of stack mounting has been introduced by Transitron Electronic Corp., Melrose 76, Mass.

These rectifiers overcome the basic limitations of germanium, selenium and copper oxide to provide smooth operation under severe environmental conditions. The "TL" rectifier stack series provides reliable operation at temperatures up to 150°C, and features voltage ranges up to 5,100 volts RMS, and current ratings up to 10 amperes. Standard stack types are available for single-phase, three-phase and six-phase power supply circuits.

This stack series is designed to meet the critical requirements of missile, aircraft and other military equipments. Four JAN type rectifiers, the IN253, IN254, IN255, and IN256, may be incorporated into these stacks.

Complete specifications and ratings are found in the manufacturer's Bulletin TE-1342.

Twin-Unit Variable Resistor

A new twist-tab mounting variable resistor, recently announced by the Electronic Components Division, Stackpole Carbon Co., St. Marys, Pa., contains two control elements and shafts mounted side-by-side on a common base, only ⅞" by 2" wide.

Known as Type TU61, the unit cuts the mounting and wiring time on television and other electronic equipment.

The variable resistor has two one-quarter-inch diameter phenolic shafts which may be adjusted from either side of the control. The shafts on the panel side are screwdriver-slotted and cut flush with the phenolic mounting plate, making the control suited for use in printed circuits where it is desired to adjust the control through the chassis. Shaft extensions from the rear are ⅜" long and are knurled for easy adjustment.

In addition to standard solder lug terminals, the controls can also be equipped with horizontal or vertical printed wiring or wire-wrap type terminals.

Type TU61 is conservatively rated at 0.75 watts for resistance values below 10,000 ohms or 0.5 watts for values above 10,000 ohms. Controls are shielded at the rear by a one-piece, nickel plated steel case.

(*Continued on page* 114)

UMI

alfax is revolutionizing graphic recording!

"ELECTRICITY IS THE INK"

IMAGINATION AND BOLD THINKING HAVE PRODUCED A COMPLETE LINE OF GRAPHIC RECORDING EQUIPMENT WHICH ANTICIPATES ALL OF THE PROBLEMS FROM TRAFFIC AND MOTION STUDIES TO HIGH SPEED IDEA TRANSMISSION.

BETTER CONTROL OF PROCESSES AND OPERATIONS

Alfax in Instrumentation

Alfax Paper and Alden Recording Techniques make possible simple fact finders to monitor from 2 to 30 operations simultaneously and for the first time, direct, visual recordings that capture faithfully the full output of electronic detection devices such as infra-red, sonar, magnetic analysis, scanning, etc.

FASTEST— MOST ACCURATE MEANS OF COMMUNICATION

Alfax in Facsimile Transmission

Alfax paper, Alden flat copy scanning, and the Alden adjusterless recording techniques provide new high speed facsimile recording systems that are the most accurate means of communication available today. Scanners transmit any copy at low or high speed to one or several recorders simultaneously in the same building or a thousand miles away.

IMAGINATION AND BOLD THINKING IN DESIGN

Top level men in the Armed Forces and industry who have witnessed the remarkable abilities of equipment made possible by Alfax have envisioned such far-reaching requirements that they have been concerned as to how it is to be made, and how it has been designed, to meet simultaneously the anticipated steep climb of demands in all the various fields where it is needed. The answer is in the—

IMAGINATION AND BOLD THINKING AT THE ALDEN RESEARCH CENTER HAVE RESULTED IN:

- ***New Techniques of Simplified Unit Design***
- ***New Techniques of Manufacture and Marketing***

● In anticipation of the tremendous possibilities in direct graphic recording made possible by Alfax Paper, a long range program to develop special, advanced equipment and processes for manufacturing has paralleled the design of Alden recorders and scanners.

Straight line production of Recorders using the Alden Work Center System.

● Because all of the electro-mechanical elements are units and all of the electronic elements are function by function chassis that slide in to connect—all assembly and most machine operations are performed on Alden Work Centers by women operators comfortably seated. Both equipment and product design have been kept under wraps until prototype operation had proved the designs in both areas suited to mass production.

WHAT ARE ALDEN WORK CENTERS?

● Alden Work Centers are prefabricated units themselves. With the methods of each unit assembly worked out, subcontracting, foreign manufacture, or dispersal of production at service centers requires no re-engineering or long training programs to meet peak or emergency requirements.

QUICK SERVICE ANYWHERE IN THE WORLD

● Alden Recording Equipment is simple, compact, and easy to service due to a system of unitized, plug-in construction for both electro-mechanical and electronic components.

● Electro-mechanical elements are divided by function into individual self-contained units. To service or change a function, merely unfasten target screws with a coin and remove unit.

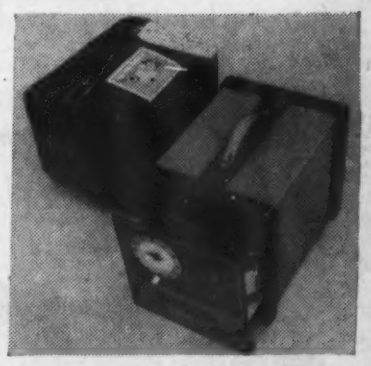
● Electronics are divided function by function with *points of check* for incoming circuits and simple "tell-tale" indicators on any chassis to make it easy to quickly isolate any trouble.

Recorders can be disassembled unit by unit by merely unfastening target screws with a coin.

Individual Electronic Recorder functions slide in or out on easily accessible Alden chassis.

SOMETHING NEW IN SPARES

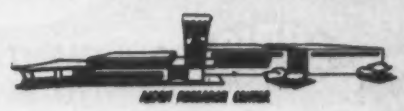
● Spare units, either chassis or electro-mechanical, instantly replace any element not functioning properly. Spare chassis in padded carrying cases can be airborne—so even half-way around the world a chassis can be replaced in thirty hours. Returned to service center, the inoperative unit parts are easily accessible and understood in the Alden open sided chassis so they are put back in operation with a minimum of delay.



Replacement chassis in padded carrying case ready for air shipment.

● ***The Armed Forces and Industry have grasped the full import of these advances which anticipate and solve many of the problems that are Armed Services objectives in procurement, sub-contracting, quality control, emergency manufacture and dispersal of facilities.***

ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIPMENT CO., Westboro, Mass.



NEW PRODUCTS

DC Signal Amplifier

Unprecedented gain stability is provided by the Micromag MMO-422 low-level magnetic DC signal amplifier, available from Magnetic Research Corporation, 200-202 Center St., El Segundo, Calif. The unit serves in various telemetering and instrumentation applications.

Incorporation of a transistor oscillator permits the Model MMO-422 to operate directly from a DC power source. Gain is therefore free from the variations normally encountered when excitation is provided by a 400-cycle line supply, which is subject to a $\pm 10\%$ tolerance. It provides ripple-free 5 VDC output from 1 millivolt DC signal input. A 22.5 VDC power supply, capable of driving 10 to 12 of the amplifiers, is available from MRC under model number MRP 21.1.

The MMO-422 finds particular application in the amplification of thermocouple and strain gauge output in industrial, military, and medical installations. It serves equally well as a very stable DC voltage amplifier for radio telemeter systems or as a high-gain DC power amplifier for relay-type temperature and servo control systems.

Telescoping Antenna Mast

A telescoping mast, ideal for mobile radio, broadcast or microwave survey work, and emergency communications, was introduced recently by Andrew Corporation, Chicago, Ill.

Available in 30-, 50-, and 100-foot hydraulic or pneumatic models, it may be mounted respectively to a station wagon, small trailer or truck, or it may be used as an independent field unit.

The valve system incorporated into each model provides coordinated sequence of sectional elevation for quick and easy guying. The 100-foot mast may be raised to full extended height in 15 minutes. The 30-foot car-top model nests 18 inches above roof-top and is operated from the vehicle's electrical system.

Complete details may be obtained by writing for Bulletin 8416, Andrew Corporation, 363 E. 75th Street, Chicago 19, Illinois.

Pulse Packages for Radar

Pre-engineered and pre-assembled radar transmitter components can now be obtained in package form from the Filtron Co., Inc., of Flushing, L.I., N. Y. and Culver City, Calif.

Designed for radar transmitter engineers, the components, when installed in radar systems, will furnish outputs which will meet reasonable performance requirements of any specific system employing a hydrogen thyratron tube.

Filtron's "High Power Pulse Package" is built around the charging choke, pulse-forming network, and pulse transformer of the line-type modulator. The package makes it possible to obtain the optimum required pulse shape, with a minimum of tedious development work or trial and error experimentation.

Filtron's "Trigger-Pulse Package" contains components schematically similar to the High Power Pulse Package but is designed specifically to generate pulses of the required power and impedance to properly trigger any high-power hydrogen thyratron tube.

"Inchworm" Linear Actuator

A linear actuator motor has been developed by Airborne Instruments Laboratory, Inc., Mineola, N. Y. Called the "Inchworm," it controls a tool's cutting edge so that parts can be machined within five millionths of an inch.

A successor to the lead screw in all mechanisms requiring microinch dimensional control, it has found its first large-scale application in the machine tool field, replacing the lead screws in centerless grinders producing precisely finished hydraulic components.

The Inchworm literally steps along in microinch steps, expanding and contracting. Employing a physical phenomenon called the magnetostrictive effect, the armature of the motor shrinks under the influence of an electromagnetic field, snapping back to original size when the magnetic field is de-energized. A pair of clamps cooperating with the armature convert the expansion and contraction undulations into forward or backward motion reversing on demand without backlash.

The Inchworm lends itself well to the automation trend in the machine tool field in that it will, through a simple converter, respond directly to gage signals. In this manner, machines may be made continuously responsive to tool variations as well as material hardness variations and the other variables that enter into precise machine finishing.

Trio Power Generators

A new line of electronic power generators, capable of delivering up to 100 volt-amperes of low-distortion power at any fixed frequency between 50 and 5,000 cps, is now available from Trio Laboratories, Inc., 4025 Merrick Road, Seaford, New York.

Designated Model DP, these instruments feature an accurate 4-inch meter that continuously monitors the generated voltage in both stand-by and operating conditions.

Easily portable and weighing only 60 pounds, the instruments are produced in four standard models: 400, 1,000, 1,600, and 2,000 cps, and are available in two versions: single, factory-set frequency, and variable frequency, panel-controlled over a range of $\pm 5\%$ of nominal. Any non-standard output frequency can be specified, and tuning fork stabilized instruments similarly can be tailored to meet exact requirements.

Intercommunication Control Center

A compact and complete intercommunication control center, suitable for institutional and business needs, has been developed by the Webster Electric Co., Racine, Wis.

This medium-sized dual channel system, called the Consolette, combines the advantages of the standard Teletalk intercommunication system with those of the large school consoles. It provides intercommunication, music distribution and paging for from one to 48 speaker locations.

Dual channel operation permits voice transmission and paging, music distribution, alarms, or general announcements to be carried on at the same time. This feature, which permits the operator to call one station without interrupting transmission of a program to all other stations, formerly was found only on the large

UMI

console-type intercoms. The Consolette also is equipped with a simple snap-on emergency all-call switch.

Precision Rotary Inverters

The Varo Manufacturing Co., Inc., 2201 Walnut Street, Garland, Texas, announces a complete line of precision-frequency rotary inverters for aircraft and missile applications. These instruments are designed to provide power in applications where frequency accuracy is critical, and are available with outputs ranging from 250 to 3,500 volt-amperes.

The inverters hold the output frequency to within 0.1% of 400 cps (0.01% on special order) despite varying load and input voltage conditions. Frequency is within tolerance in less than ½ second when maximum load is instantly applied and input voltage is simultaneously dropped from rated maximum to rated minimum.

The Varo Electronic Speed Control is contained within the inverter's standard control box and requires no additional space.

Video Distribution Amplifier

A compact video distribution amplifier, Model PA-1002, with advanced features is available from General Precision Laboratory, Inc., Pleasantville, N. Y.

It is designed for use in the distribution and transmission of video signals, both color and monochrome, within television broadcast stations and equipment design laboratories. This unit is capable of anv number of outputs from a common input signal source, all isolated from the input reflected back into the signal source.

The entire amplifier plugs into its own frame, permitting rapid replacement of amplifier units. The frame, Model PA-1003, can accommodate a total of eight amplifiers. Two filament transformers built into the frame supply voltage for all tube heaters. The frame also contains a pair of compensation inductors for each amplifier input which effectively neutralizes input capacity, thus maintaining resistive line termination.

Brushless Engine Generator Unit

A brushless engine generator unit has been developed by Georator Corp. of Manassas, Va., as a light, rugged portable source of high frequency power.

The unit consists of a "Nobrush" 400 cycle generator mounted on an aluminum frame, four cycle engine. It provides standard voltages and its output is 500 watts. The unit's equipment includes a rewind starter and a mechanical governer for close frequency control.

As the generator housing is coupled directly on the engine frame and the rotor is mounted directly on the engine shaft, bearings, other than those in the engine itself, are eliminated.

The unit serves as a source of power for electronic field devices, portable radios, and geophysical apparatus. It will operate most electronic devices designed for 60 cycle service, as well as usual incandescent lamps and heating devices.

Our Book Department will furnish any book reviewed in SIGNAL. A 10% discount allowed all Association members on orders of $10 or more. Please indicate author and publisher where known and allow three weeks for delivery.

New Literature

Electrical Testing Bulletin

A 72-page bulletin covering its services and facilities has just been published by the Electrical Testing Laboratories, Inc., an independent laboratory.

This bulletin contains more than 70 photographs and covers typical measurements and determinations made on hundreds of products and materials. It covers chemical, electrical, electronics, mechanical and physical, and photometric, radiometric and colorimetric testing. It also describes spectroscopy, photomicrography, environmental, near-infrared and ultraviolet facilities.

Switch Bulletins

Two bulletins are available from the Telephone Division of Stromberg-Carlson, which describe their electro-mechanical switches, originally designed for service in telephone systems and now available for industrial application.

Bulletin T-5001 gives specifications and features of the Stromberg-Carlson stepping switches, and Bulletin T-5002 describes key switches and mountings.

These bulletins may be obtained by writing to: Manager, Industrial Sales, Telephone Division, Stromberg-Carlson Co., Rochester 3, N. Y.

NOW

increased operational versatility . . greater accuracy in RF, VHF and UHF SPECTRUM ANALYSIS

with the IMPROVED

PANORAMIC PANALYZOR

MODEL **SB-8b**

Check these advanced engineering features:

NEW Continuously variable scanning rate from 1 thru 60 scans/sec with one control. Three selectable modes . . . free running, line synch or external synch.

NEW Three selectable types of amplitude displays . . . Square law exponential, Linear 20 db. Log 40 db.

NEW Flat face CRT, edge lit calibrated screen and camera mount bezel for photographic records—optional.

NEW Differential markers to show frequency dispersion available in the Type T-10,000.

The Panalyzor Model SB-8b is available in three types:

Type	Sweepwidth Range	Resolution Range
T-200	200 kc—0 kc	50 cps—4.5 kc
T-1000	1 mc—0 mc	400 cps—10 kc
T-10,000	10 mc—0 mc	9 kc—100 kc

Write today for complete specifications and prices.

PANORAMIC
RADIO PRODUCTS, INC.

We'll be at the N.E.C. booth **198**

15 So. Second Ave., Mount Vernon, N.Y.
MOunt Vernon 4-3970
Cables: Panoramic, Mount Vernon, N.Y. State

NEW PRODUCTS

Silicon Diode Brochure

Microwave Associates has published an eight-page microwave silicon diode brochure, Catalog 56S.

Intended to bridge the gap between the specification and application of diodes, it is directed to the designer of microwave receivers and test equipment as well as production, maintenance, and purchasing personnel. Highlighting recent advances in the field, the brochure illustrates mixer and video diodes for operation over the 1000 to 75,000 mc/s range.

Subjects discussed in Catalog 56S include: factors in silicon diode selection, silicon versus germanium, diodes as video detectors, mixer diode considerations, reversible polarity diodes, diodes for high level with performance curves and data of modulator use, diode pairs for balanced mixer use, broader band widths, pricing, selection and inspection, and recent achievements in low noise diodes performance.

The booklet is available from Microwave Associates, 22 Cummington Street, Boston, Mass.

Revere "Permacode" Bulletin

"Permacode" extruded teflon hookup wires are described in Bulletin No. 1901 published by Revere Corp. of America, Wallingford, Conn.

"Permacode" wires, which provide identification with the color extruded throughout the insulation, are available in fifteen solid colors or in striped combinations of two, three, or four of the solid colors.

The bulletin includes constructions of various gage sizes built to meet requirements of Military Specification MIL-W-16878, types E and EE, and gives ordering information.

Servo Bulletin

Technical Bulletin 1300-1, "Servotherm Thermistor Heat Detector Cells" provides pertinent information on the basic nature and construction of Servo Corp. of America's thermistor bolometers.

Static characteristics, dynamic characteristics, noise level, infrared transmitting windows and circuit design considerations are discussed in this illustrated brochure.

The described units are designed for use in heat detection, measurement or control systems where direct contact with the source is inadvisable or impossible. They can, for instance, detect infrared radiation in the spectral region from 1 to 12 microns or more.

A copy of Bulletin 1300-1 may be obtained by writing to W. K. Schoonmaker, Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, Long Island, N. Y.

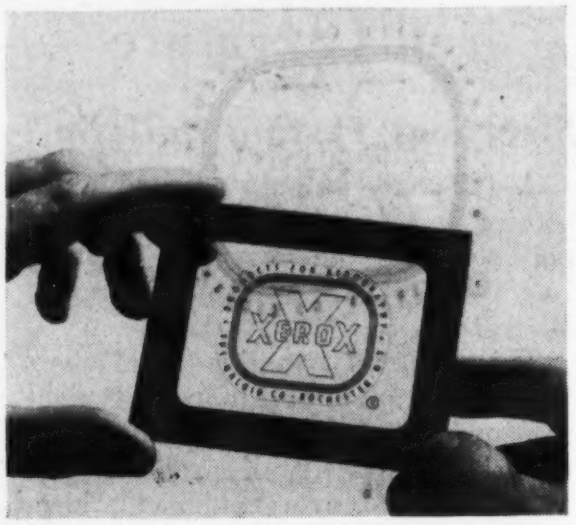
For the Photographer

Lantern Slide Transparencies by Xerography

Transparencies for lantern slides and overhead projectors may now be made by Xerography, the Haloid Co., 2-20 Haloid St., Rochester 3, N. Y., has announced.

The company points out that transparencies made by conventional methods now require up to an hour or more, whereas Xerography will not only do the job in about three minutes, but will cut material costs by more than half.

The Xerographic copying process is a clean, fast, dry, electrostatic copying process requiring neither darkrooms, liquid chemicals, nor water. In the preparation of transparencies by this method, the need for an intermediate negative is also eliminated.



Production time is reduced to 3 minutes, and cost to half, in the Xerography method of making slide transparencies.

In the Xerographic preparation of projection transparencies, the copying and fusing of an original document onto acetate requires only about three minutes. For lantern slides the acetate is then trimmed to the desired size, sandwiched between identically sized cover glasses and their edges bound with tape.

New Hybrid Light Source

A radically new light source designated the Fluormeric has been developed by the Duro-Test Corp., North Bergen, N. J.

The new lamp consists of three sources in one glass bulb, each of which emits light of a different kind. The three sources are gaseous discharge as in a quartz mercury vapor lamp; fluorescing of activated phosphor powders as in a fluorescent lamp, and by tungsten filament as in an ordinary incandescent lamp.

According to the company, the Fluormeric lamp is more durable and efficient than existing light sources. Its average efficiency is claimed to be 25 lumens per watt compared to 18 lumens per watt for incandescent sources.

An unusual feature of the lamp is a life of 12,000 hours as compared to 750 hours for a typical incandescent lamp.

The color spectrum of the Fluormeric combines the yellow-red of the incandescent, the blue-green of the mercury vapor, with the flexibility of fluorescent phosphors to produce a color range comparable to sunlight. The lamp may be designed to operate at 3200 degrees Kelvin or 3800 degrees Kelvin.

For photographic purposes it appears that the lamp may possess a number of applications such as straight photographic lighting, printing and possibly projection. The lamp will be available in wattages of 100 up and may be screwed directly into an ordinary lamp socket. The lamp does not require a transformer for operation.

Kodascope Sound Projector

A 16-mm movie projector that permits addition of background music and narration to business or industrial films without special equipment and elaborate sound studios has been announced by the Eastman Kodak Co., Rochester 4, N. Y. The projector combines the principles of a tape recorder and a movie projector into one compact, portable unit which makes sound movies as inexpensively as most silent movies.

With the projector, a company may first make a 16-mm film, have an inexpensive magnetic striping added, and then record narration and background music in the company's own office or plant.

A microphone is supplied with the projector and the proper recording volume can be pre-set; a flashing light indicates the correct recording level at all times. The projector is designed so that a record player, tape recorder, or other sound source can be plugged into it for direct recording.

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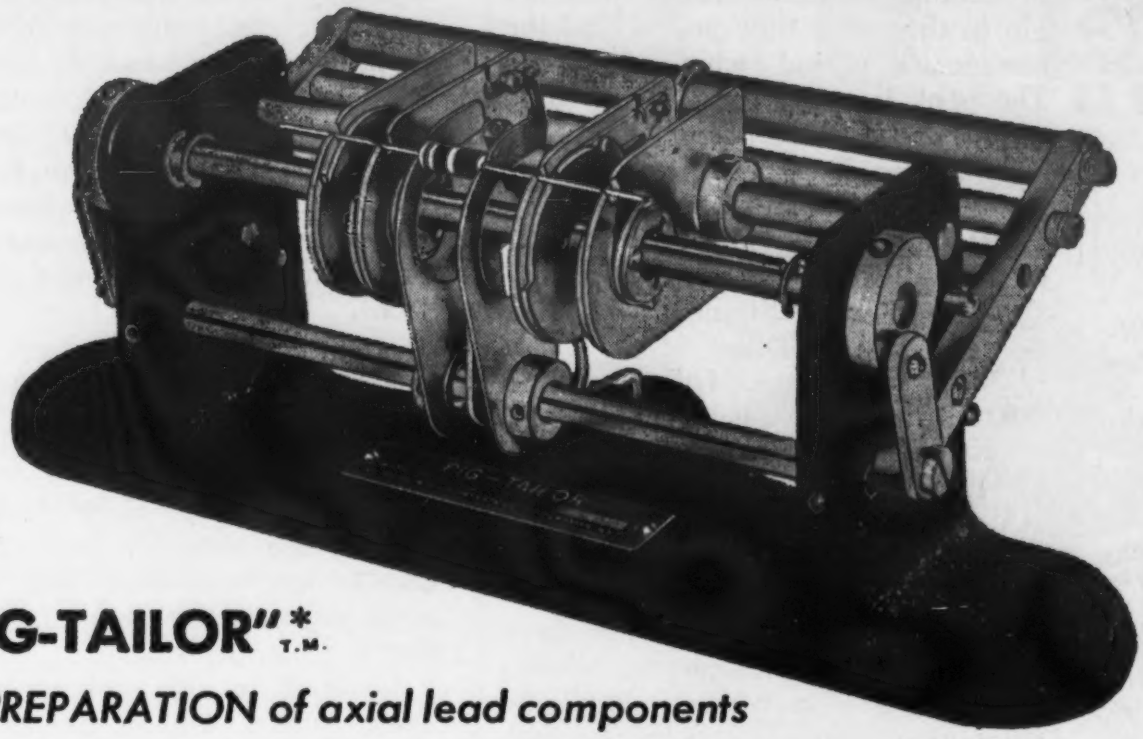
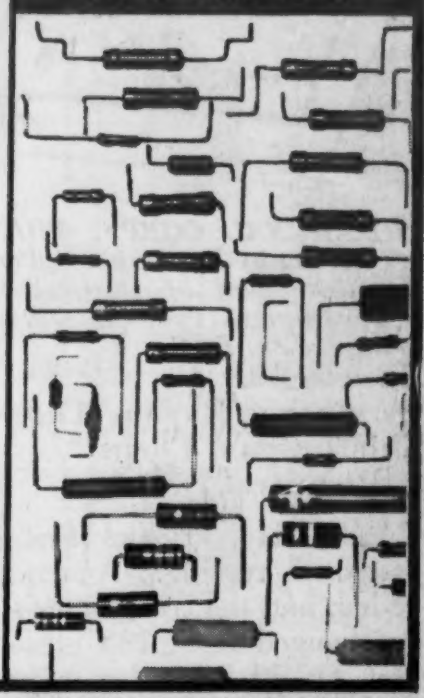
PROVEN-on the assembly line!



"PIG-TAILOR"* T.M.

For PREPARATION of axial lead components

PREPARED COMPONENTS IN SECONDS WITH THE "PIG-TAILOR"



"PIG-TAILORING"

. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.

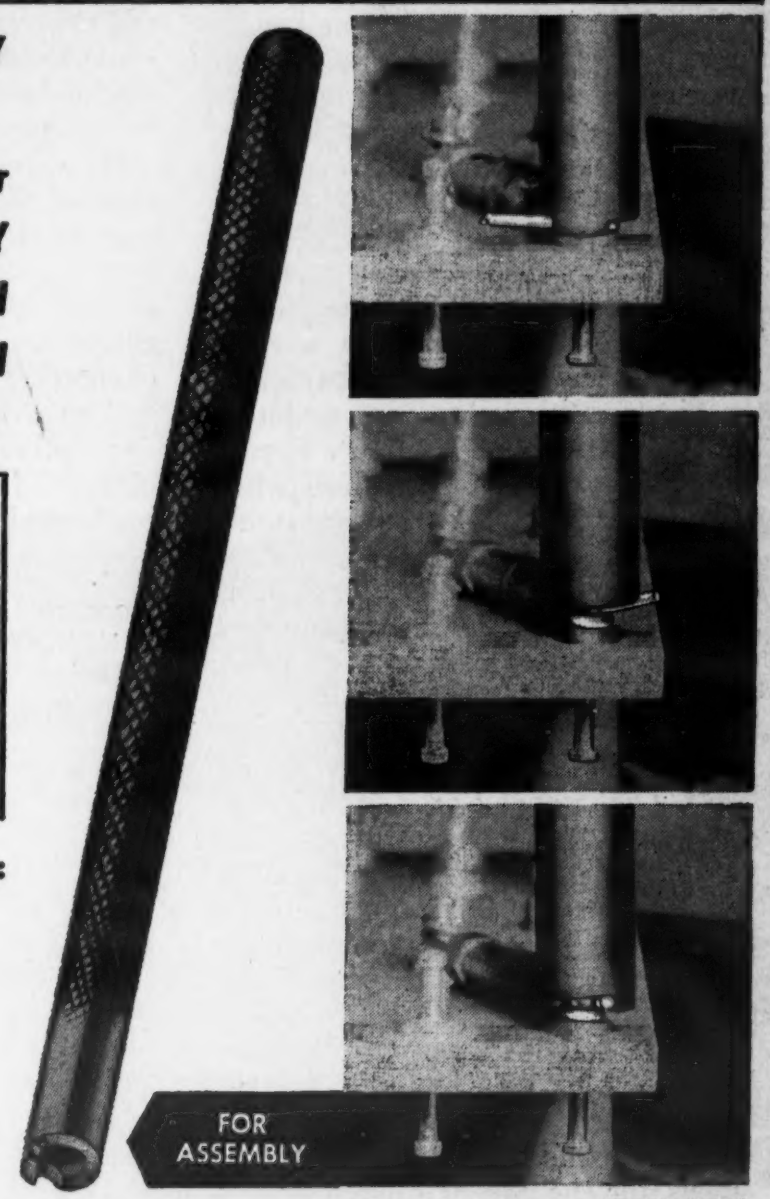
The "PIG-TAILOR" plus "SPIN-PIN"—accurately MEASURES, CUTS, BENDS, EJECTS & ASSEMBLES both leads simultaneously to individual lengths and shapes—3 minute set-up—No accessories—Foot operated—1 hour training time.

PIG-TAILORING provides:

1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits.
6. Individual cut and bend lengths.
7. Better time/rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery.

PIG-TAILORING eliminates:

1. Diagonal cutters!
2. Long-nose pliers!
3. Operator judgment!
4. 90% operator training time!
5. Broken components!
6. Broken leads!
7. Short circuits from clippings!
8. 65% chassis handling!
9. Excessive lead tautness!
10. Haphazard assembly methods!



"SPIN-PIN"* T.M. Close-up views of "SPIN-PIN" illustrate fast assembly of tailored-lead wire to terminal.

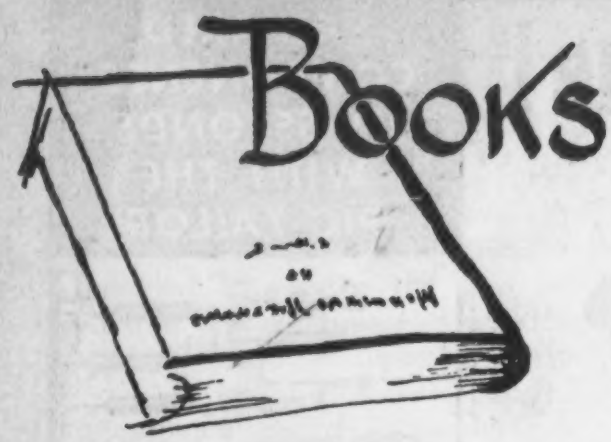
* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. S 9P

BRUNO-NEW YORK INDUSTRIES CORPORATION

DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT

460 WEST 34th STREET • NEW YORK 1, N. Y.



THE SIGNAL CORPS, THE EMERGENCY, by Dr. Dulaney Terrett. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Reviewed by
Dr. George Raynor Thompson
Chief, Signal Corps
Historical Division

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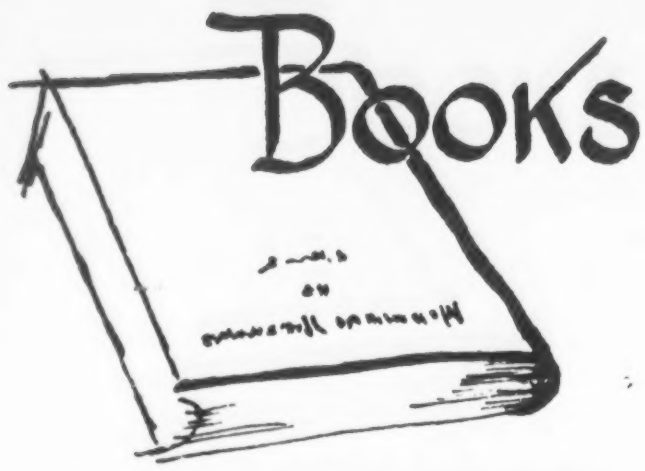

THE SIGNAL CORPS, THE EMERGENCY, by Dr. Dulaney Terrett. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Reviewed by
Dr. George Raynor Thompson
Chief, Signal Corps
Historical Division

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RADIO RECEIVER LABORATORY MANUAL, by Alex W. Levey. John F. Rider Publisher, Inc., New York, N. Y., 112 pages, $2.00.

This manual has been designed to give students in radio servicing a good basic introduction into the construction, analysis, testing and repair of a radio receiver. An adequate background of DC, AC and vacuum tube theory is necessary.

Constructed during the course is a six-tube, two-band superheterdyne receiver. The experiments included in the laboratory work are divided into two major categories: the construction and analysis of a circuit, and the use of test equipment to analyze the circuit. Demonstrations by the instructor for better understanding of the subject are also included in the text.

ELEMENTS OF PULSE CIRCUITS, by F. J. M. Farley. John Wiley & Sons, Inc., New York, N. Y., 143 pages, $2.00.

Written as an introduction to pulse circuits for physicists and research workers, this book assumes that the reader has knowledge of the fundamentals of radio practice and deals with pulse waveforms immediately after only a brief discussion of elementals.

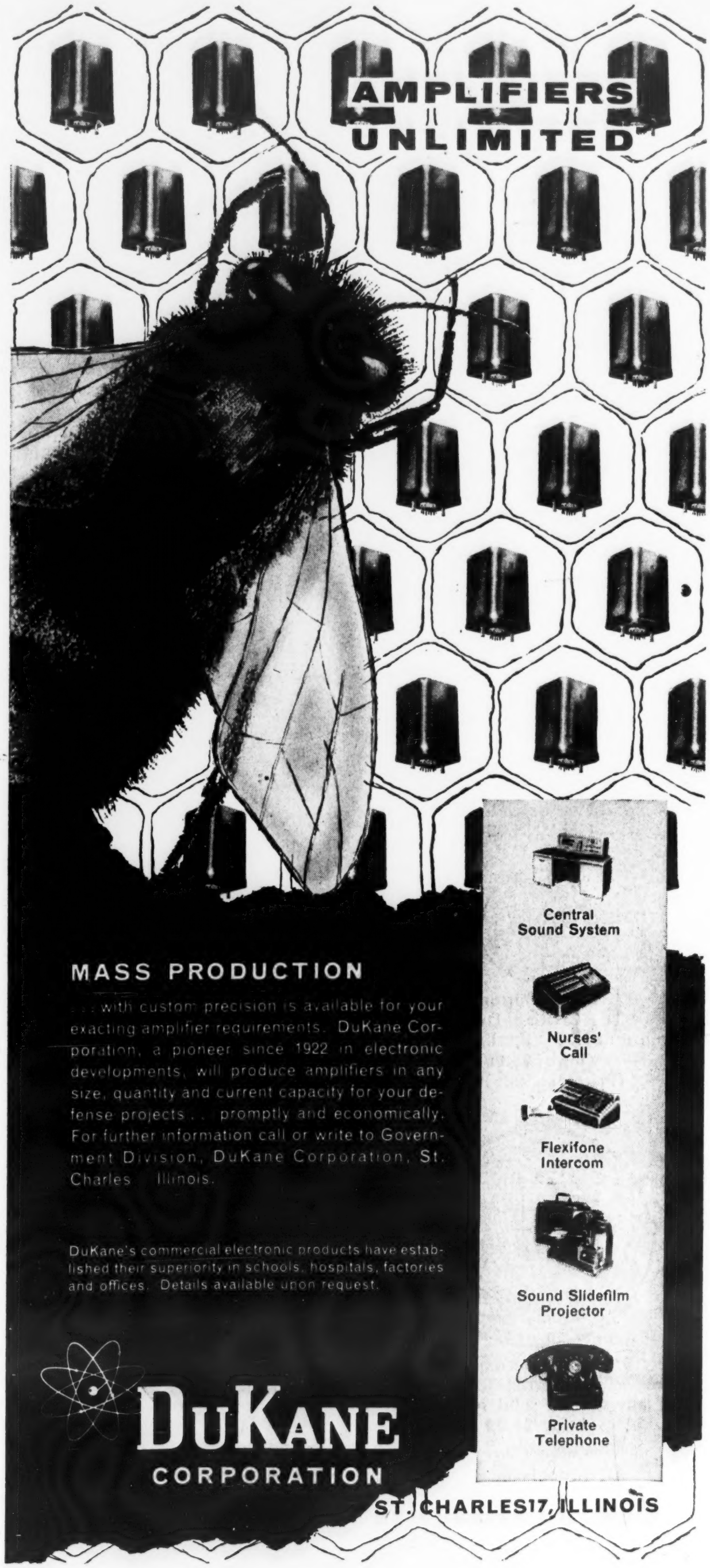
However, the approach to the subject is primarily non-mathematical despite occasional mathematical statements, and a course in advanced physics is unnecessary for understanding of the material. Also, certain topics are omitted because the general radioman will not have the essential equipment available, for example, the use of transmission lines for pulse shaping.

No attempt is made to trace the sources of circuit information since such detailed references would be difficult for this type of book.

ATOMS AND ENERGY, by H. S. W. Massey. Philosophical Library, Inc., New York, N. Y., 174 pages, $4.75.

The central topic of this work on atomic energy is the relationship of atomic research to atomic energy, with attention given to the research methods used in modern physics.

A non-technical account of the steps in developing and releasing atomic energy, this volume details the similarities and differences between the processes taking place in ordinary combustion and in nuclear fission. The nature and possibilities of the hydrogen bomb are also discussed.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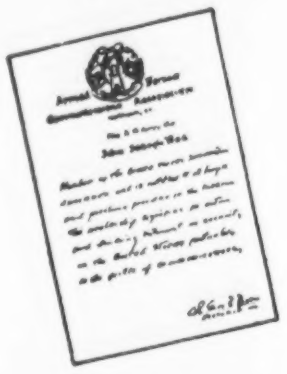

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